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Edward J. Cuhaci and Associates Architects Inc. – 700 Cope Drive Stittsville High School Detailed Noise Impact Study

Dear Tim,

We are pleased to present the following detailed noise study for the new development of a new high school located at 700 Cope Avenue in Stittsville, Ontario, for which the City of Ottawa has requested a traffic noise study and a stationary noise study to be performed as stated in the pre-consultation meeting notes from February 20, 2019. This noise study is required by the City of Ottawa under the Environmental Noise Control Guidelines 2016 (ENCG), compliant with the Ministry of Environment, Conservation and Park's NPC-300. This report is a detailed noise study, which is an update of the feasibility noise study dated July 18, 2019.

This study considers two different acoustic concerns:

1) Stationary Noise Impact Study – the noise impact this new development will have the surrounding environment
2) Traffic Noise Impact Study – the noise impact from the nearby traffic sources to the new high school

In Section 2.0, this study analyzes the surrounding area using a scaled area plan and determines the noise impact of noise generating equipment on the high school property to the surrounding environment, including recommendations on how to reduce noise levels to acceptable levels and an analysis with these recommendations implemented. We have also analyzed, in Section 3.0, the predicted noise impact from traffic noise sources onto this development and resultantly performed a building component review to determine if the indoor noise criteria in the ENCG have been met. This noise study is based on the most recent architectural plans from the architect and the mechanical plans, manufacturer equipment data, and operation schedule provided by the mechanical engineers. Should this information change, such as the operation schedule, a revised report will be necessary.

If you have any questions, please do not hesitate to contact us.

Regards,

Jessica Kyoz, P.Eng.
Acoustic Consultant

Karim Sachedina, M.A.Sc.
Acoustic Consultant

Contents

1.0 Introduction & Site Description

State of the Art Acoustik Inc. has been commissioned by Cuhaci Architects to complete a noise study for the new development of a high school at 700 Cope Drive in Stittsville, Ottawa, Ontario. The school consists of a multi-story building with rooftop equipment, a generator, and interior equipment that is ducted to louver or roof vents. It is located near current and proposed residential areas. We have analyzed the noise from the new equipment at the closest points of reception in order to determine the worst case scenario.

1.1 Scaled Area Location Plan

Figure 1.1 and Figure 1.2 below show the location of the new Stittsville High School, including the surrounding area and site plan. Adjacent noise sensitive buildings include current and future residential homes.

Figure 1.1 – Location of new Stittsville High School and surrounding area.

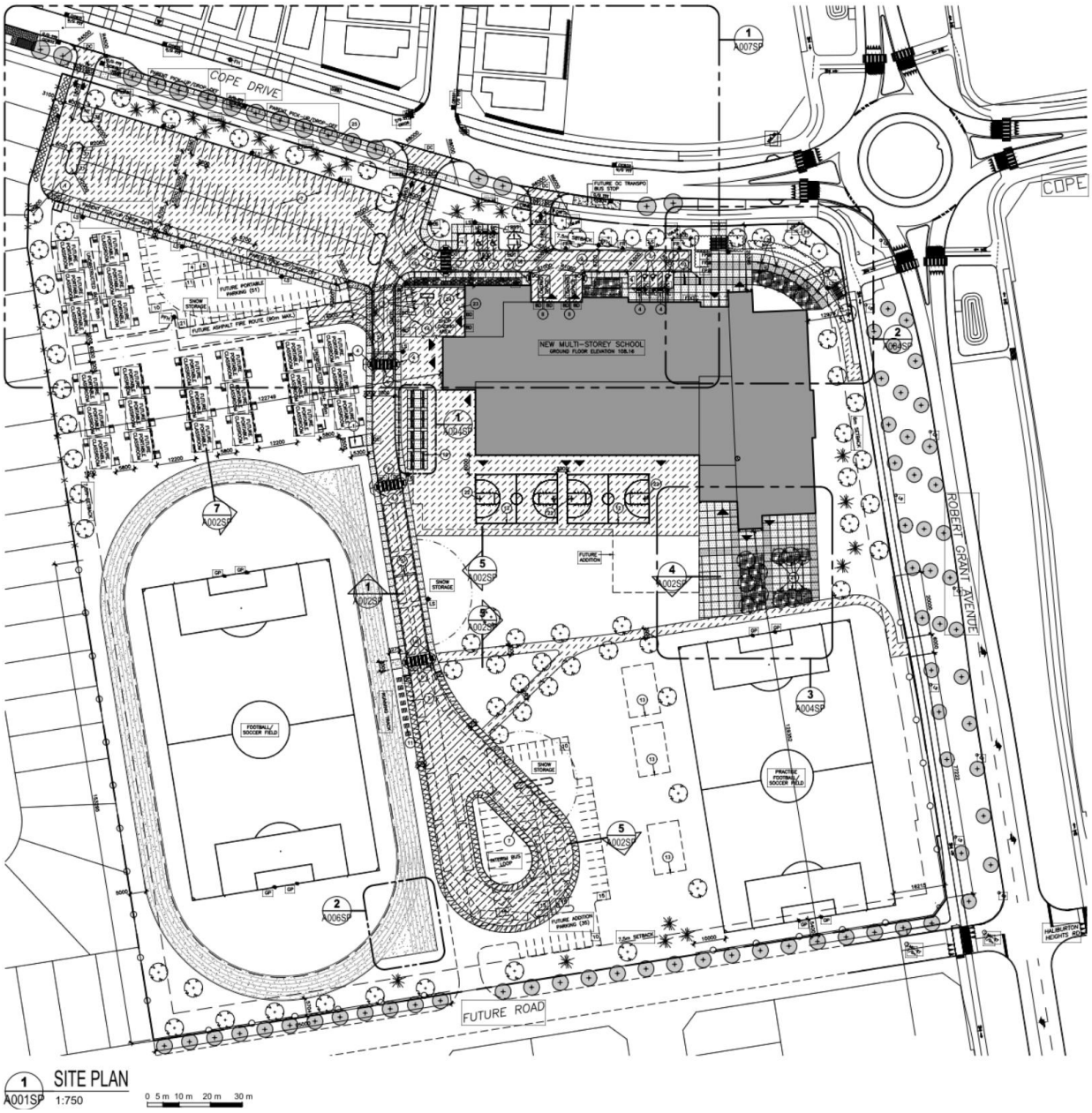


Figure 1.2 – Site plan of Stittsville High School.

Figure 1.2 shows the updated site plan from November 2019, which shows the school has an increased setback from the roads Cope Drive and Robert Grant Avenue compared to the previous site plan from May 2019.

2.0 Stationary Noise Impact Evaluation

In this section we provide our stationary noise assessment. We detail the noise limits, noise sources, points of reception used in our modeling, modeling and calculation procedures, and predicted noise levels.

2.1 City of Ottawa Noise Bylaw & Enviornmental Noise Guidelines for Environmental Noise

The City of Ottawa Noise Bylaw and ENCG have the same limit for daytime permissible Sound Pressure Level (SPL) at a noise sensitive location in a Class 1 area of 50 dBA. The Bylaw is to be used in conjunction with the City of Ottawa Environmental Noise Control Guidelines (ENCG), which are based on the Ministry of Environment, Conservation and Parks (MECP) NPC-300 Noise Control Guidelines. The City of Ottawa ENCG requires a 45 dBA SPL at night or ambient noise, whichever is higher. Therefore, when analyzing equipment for environmental noise studies, all non-emergency equipment in operation during the day and at night must meet the ENCG limit of 50 dBA during the day and 45 dBA at night. The points of reception are chosen at the nearest current and potential residential homes, which will allow us to calculate the largest noise impact and mitigate it accordingly. It should be noted that for emergency equipment, NPC-300 allows a 5 dBA excess over the other limits, i.e. 55 dBA during the day. However, the City of Ottawa Noise Bylaw does not allow sources to produce levels above 50 dBA.

2.2 Significant Noise Sources and Operation Hours

The noise sources which are being considered for this assessment of the mechanical noise to nearby residences is summarized in Table 2.1 below.

Noise Source	Quantity, tag(s)	Location	Operation Schedule
Energy recovery ventilators	x3, ERV-1-3	ERV-1-2: rooftop ERV-3: interior, ducted to louvers	ERV-1-2: Continuous ERV-3: School hours
Chillers	x2, CH-1-2	Rooftop	School hours
Rooftop air handling units	x4, RTU-1-4	Rooftop	School hours
Exhaust fans	x10, EF-1-10	Rooftop	EF-1-4: Continuous EF-5-10: School hours
Kitchen exhaust fan	x1, KEF-1	Rooftop	School hours
Condensing units	x2, CU-1-2	Rooftop	Intermittent; as needed
Interior air handling units	x7, AHU-1-7	Interior, ducted to louvers/roof vents	School hours
Generator	x1, GEN	Ground	Testing and emergency

Table 2.1 – Quantity, location, and operation schedule of noise sources considered.

Table 2.1 shows that most of the considered noise sources are located on the rooftop of the high school. The interior air handlers (AHU-1-7) are ducted to louvers or roof vents and are therefore a source of noise to the outside. Only the ERVs and some of the exhaust fans will be running continuously. The condensing units will run intermittently, as needed, and the generator will only be

running during testing, which is expected occur for a brief period during the day once a month, and in emergency situations. The rest of the equipment will only run during school hours, which is from 8 am to 4 pm on weekdays. For the purposes of this report, the equipment that only operates during school hours will be considered for the 'daytime' analysis, where the noise limit is 50 dBA. Only the equipment that runs continuously and the condensing units will be considered for the 'nighttime' analysis, where the limit is 45 dBA.

The sound data for the equipment considered in our evaluation is summarized in Table 2.2 below.

	Octave Band Sound Power Levels (dB)								
Noise Source	**63 Hz**	**125 Hz**	**250 Hz**	**500 Hz**	**1 kHz**	**2 kHz**	**4 kHz**	**8 kHz**	**dBA**
ERV-1[1]	82	79	87	83	84	81	75	68	88
ERV-2[1]	87	84	92	88	89	86	80	73	93
ERV-3[2]	86	86	76	69	69	64	59	54	75
CH-1, CH-2	93	95	95	94	96	88	86	80	99
RTU-1, RTU-2[3]	80	74	76	76	75	72	73	65	80
RTU-3[3]	80	74	76	76	75	72	73	65	80
RTU-4[3]	85	85	81	78	76	71	64	57	81
EF-1, EF-2, EF-3, EF-4	73	71	68	62	59	59	55	46	66
EF-5, EF-6, EF-7, EF-8	71	73	74	63	59	61	51	43	69
EF-9	79	76	71	65	61	57	53	47	69
EF-10	80	80	88	72	68	67	62	54	81
KEF-1	70	69	83	77	69	54	61	60	78
CU-1, CU-2[2]	67 dBA SPL @ 1 m								
AHU-1[4]	74	74	80	74	68	66	60	53	76
AHU-2[4]	75	75	82	76	70	68	62	54	78
AHU-3[4]	77	74	83	75	71	70	66	58	79
AHU-4[4]	75	75	83	76	71	70	65	57	79
AHU-5[4]	76	77	83	77	71	69	63	55	79
AHU-6[4]	74	73	80	73	67	65	59	53	75
AHU-7[4]	70	67	71	71	62	63	59	51	71
GEN	73 dBA SPL @ 7 m								

Table 2.2 – Octave band sound power levels of noise sources.

[1]sound power level at free outlet;

[2]current equipment sound data unavailable, data approximated based on size of units;

[3]radiated sound power level; [4]return sound power level

2.3 Equipment Site Plan

The figures below show the latest plans used to identify the locations of the sound generating equipment. Figure 2.1 and Figure 2.2 show the rooftop equipment, and Figure 2.3 to Figure 2.7 show the locations of the interior air handlers, which are ducted to louvers or roof vents. Figure 2.8 shows the location of the generator.

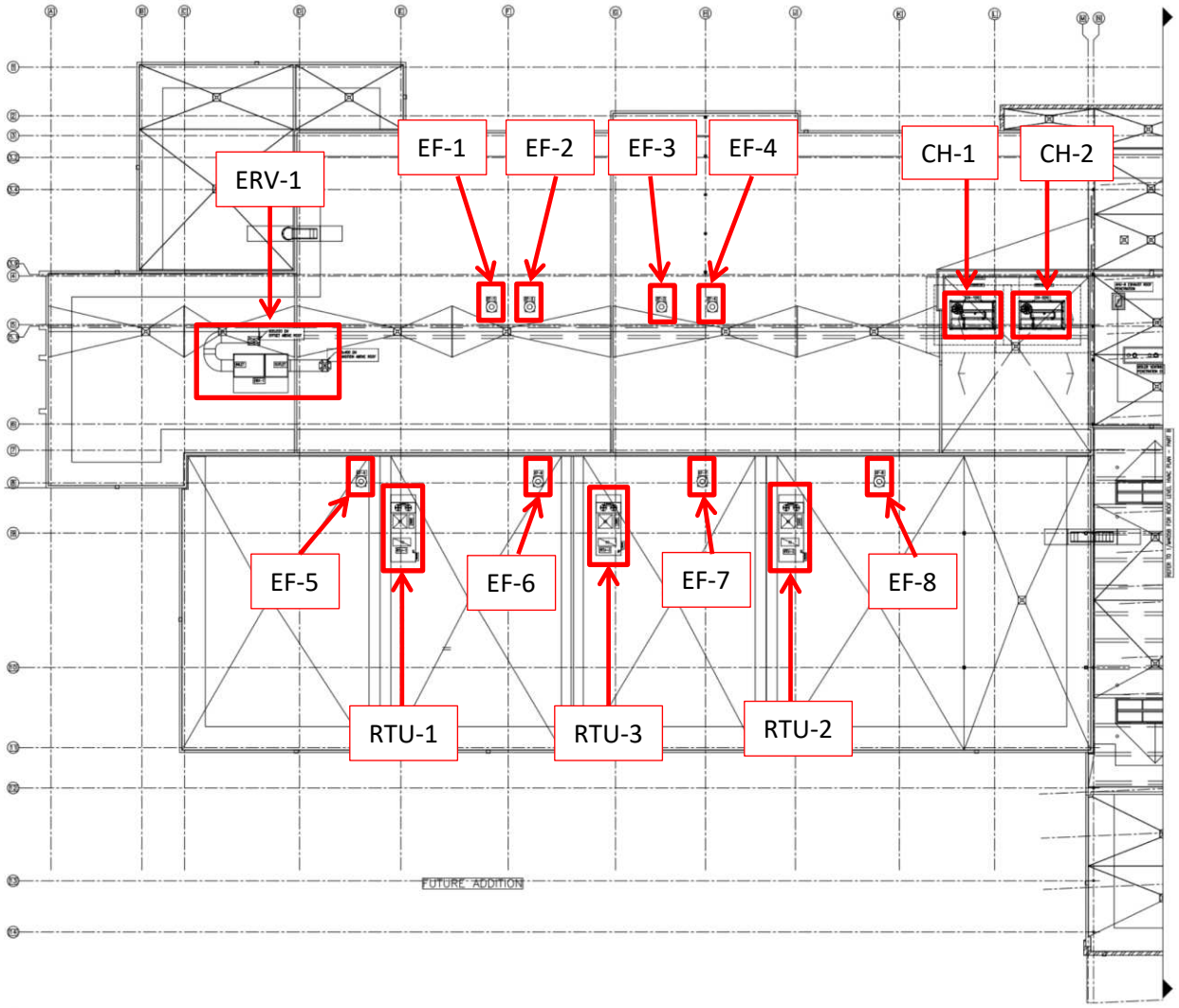


Figure 2.1 – Rooftop mechanical plan (West side) showing locations of considered equipment.

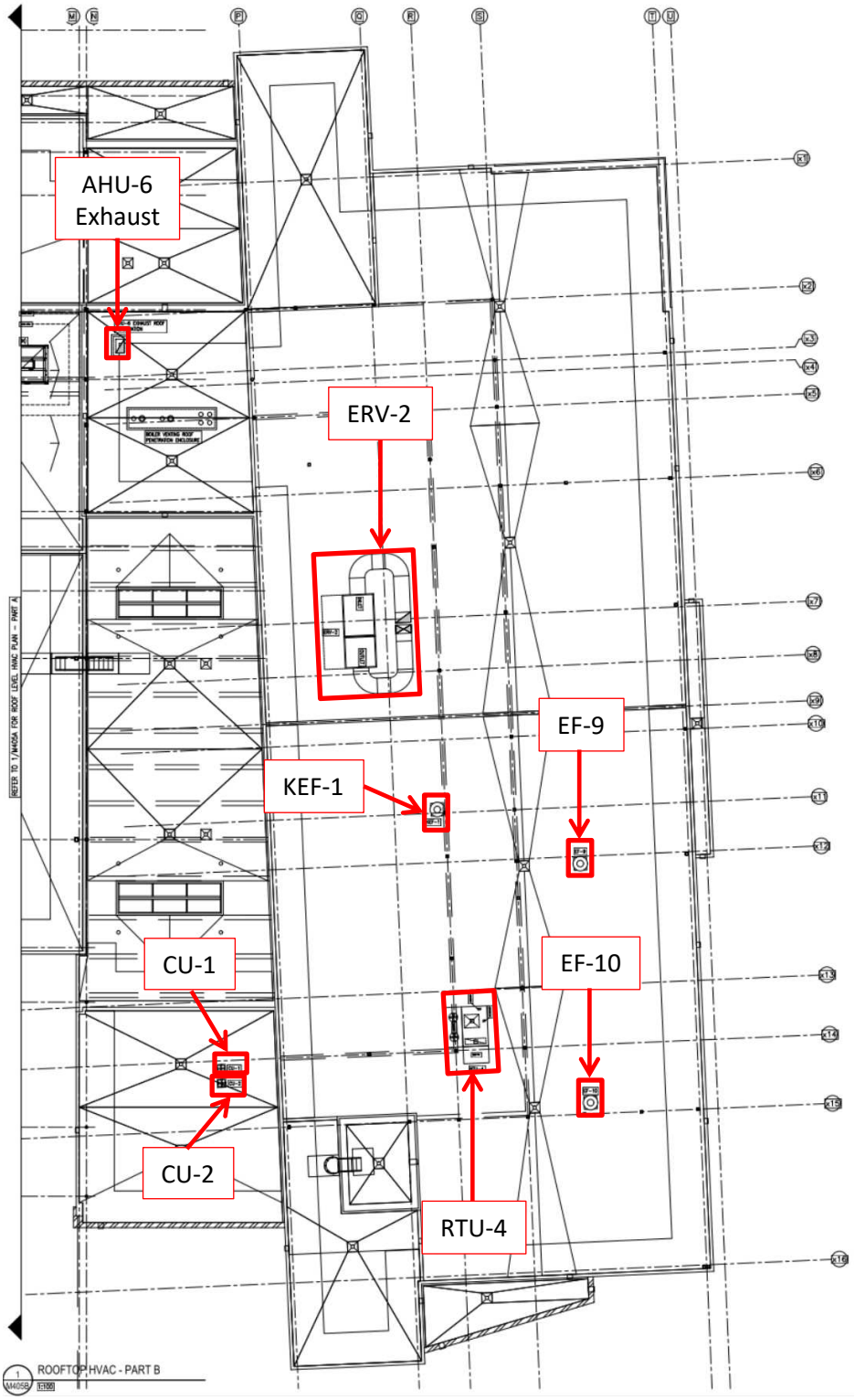


Figure 2.2 – Rooftop mechanical plan (East side) showing locations of considered equipment.

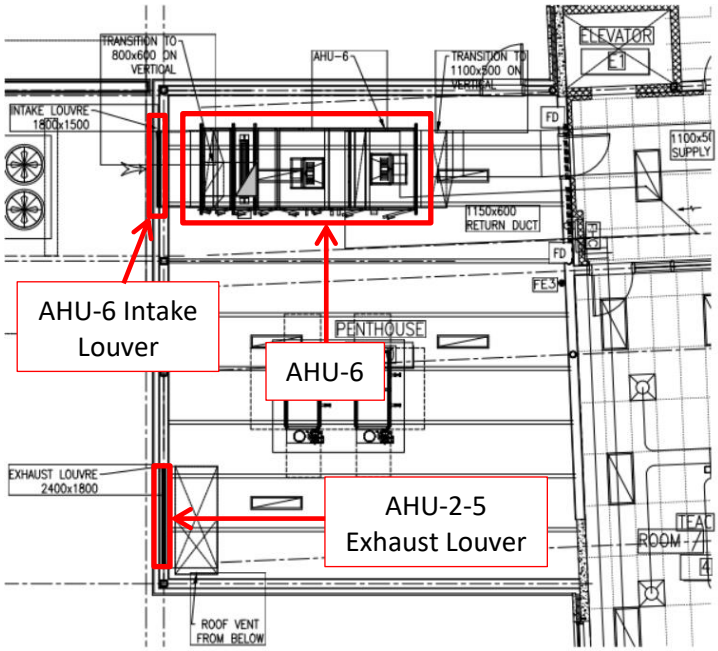


Figure 2.3 – Fourth floor mechanical penthouse plan showing location of considered equipment.

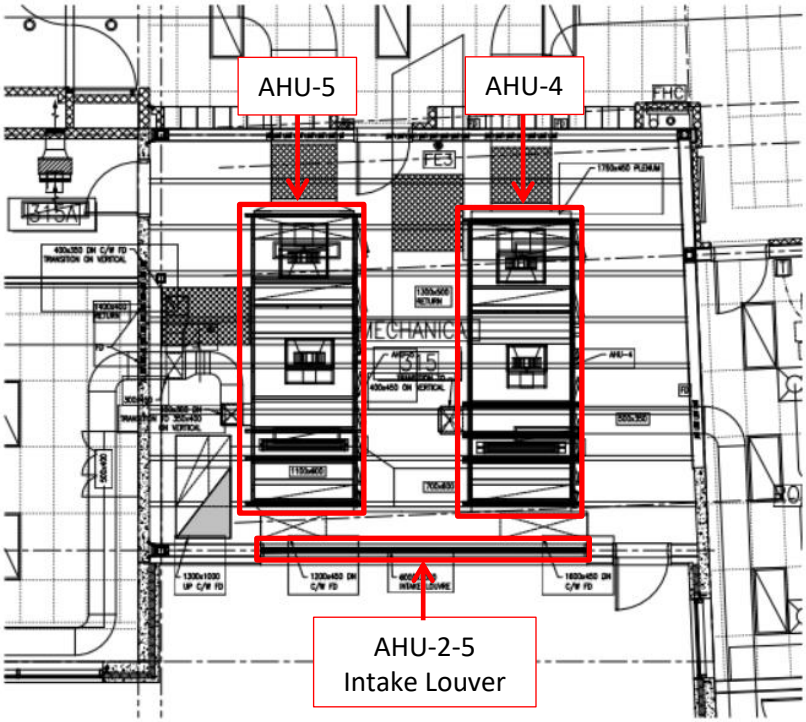


Figure 2.4 – Third floor mechanical room plan showing locations of considered equipment.

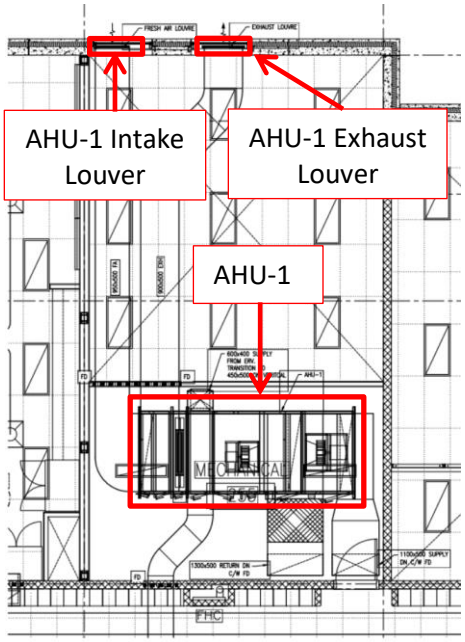


Figure 2.5 – Second floor West mechanical room plan showing location of considered equipment.

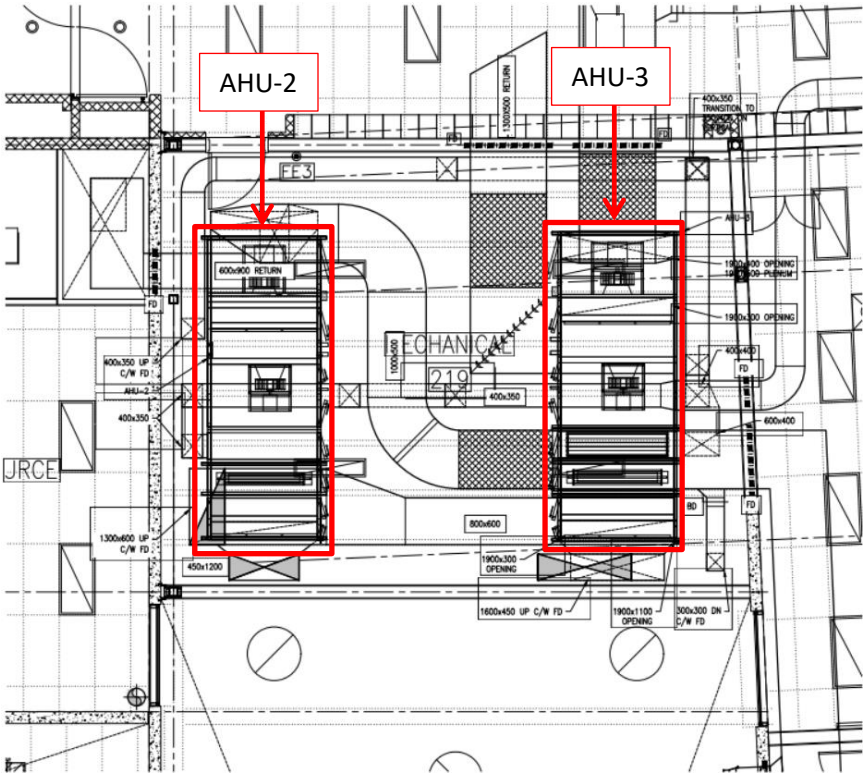


Figure 2.6 – Second floor East mechanical room showing locations of considered equipment, intake and exhaust for AHU-2-3 shown in Figures 2.4 and 2.3, respectively.

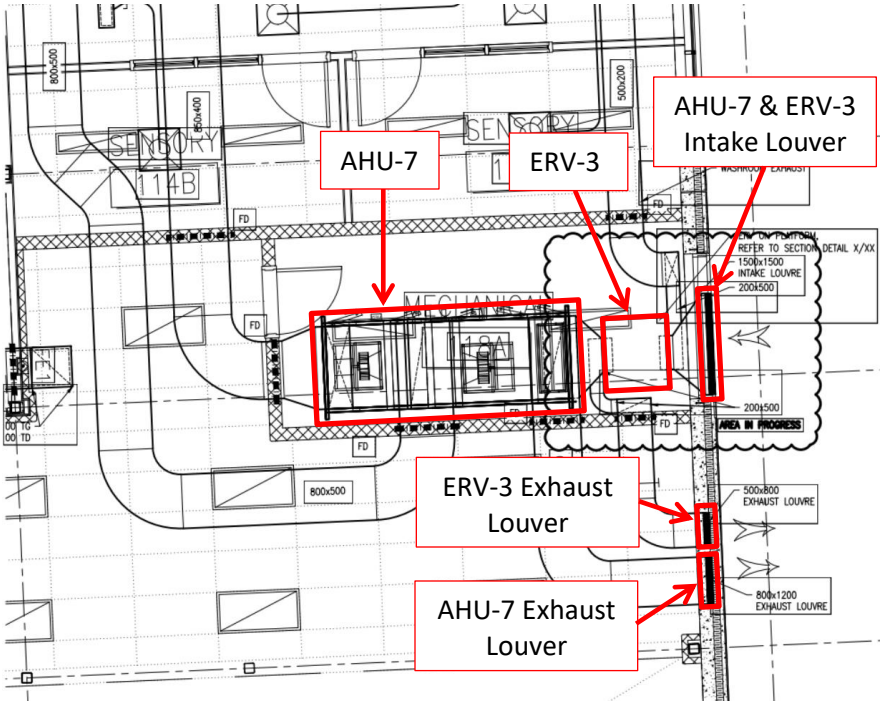


Figure 2.7 – First floor mechanical room plan showing location of considered equipment.

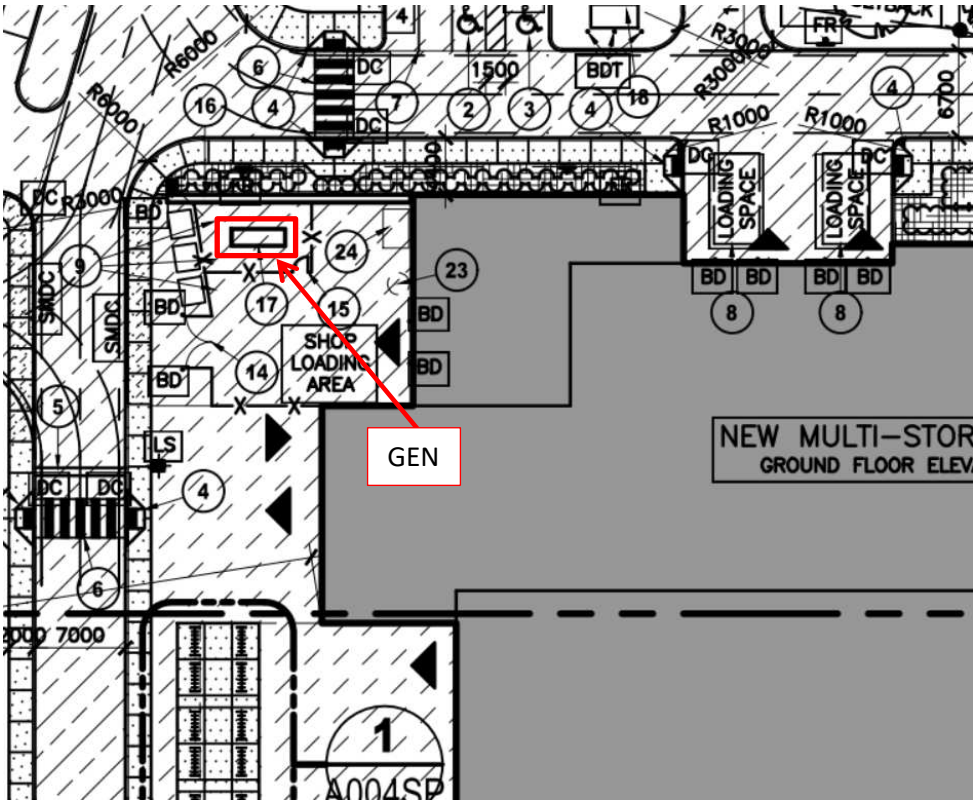


Figure 2.8 – Site plan section showing location of generator.

2.4 Points of Reception

Points of reception (PORs) have been selected to evaluate the noise levels at locations of nearby current and future residences. Figure 2.9 shows the locations and heights of the PORs used. POR A is located on the north side of Cope Drive, which is zoned for future residential use. POR B is located east of Robert Grant Avenue, between future and existing residential buildings. PORs C and D are located just west of the school's property line, in an area which is also zoned for future residential use. Since the rooftop equipment is the greatest source of noise, a height of 4.5 m was chosen for the PORs, which is the typical height of a second story window of a residential home.

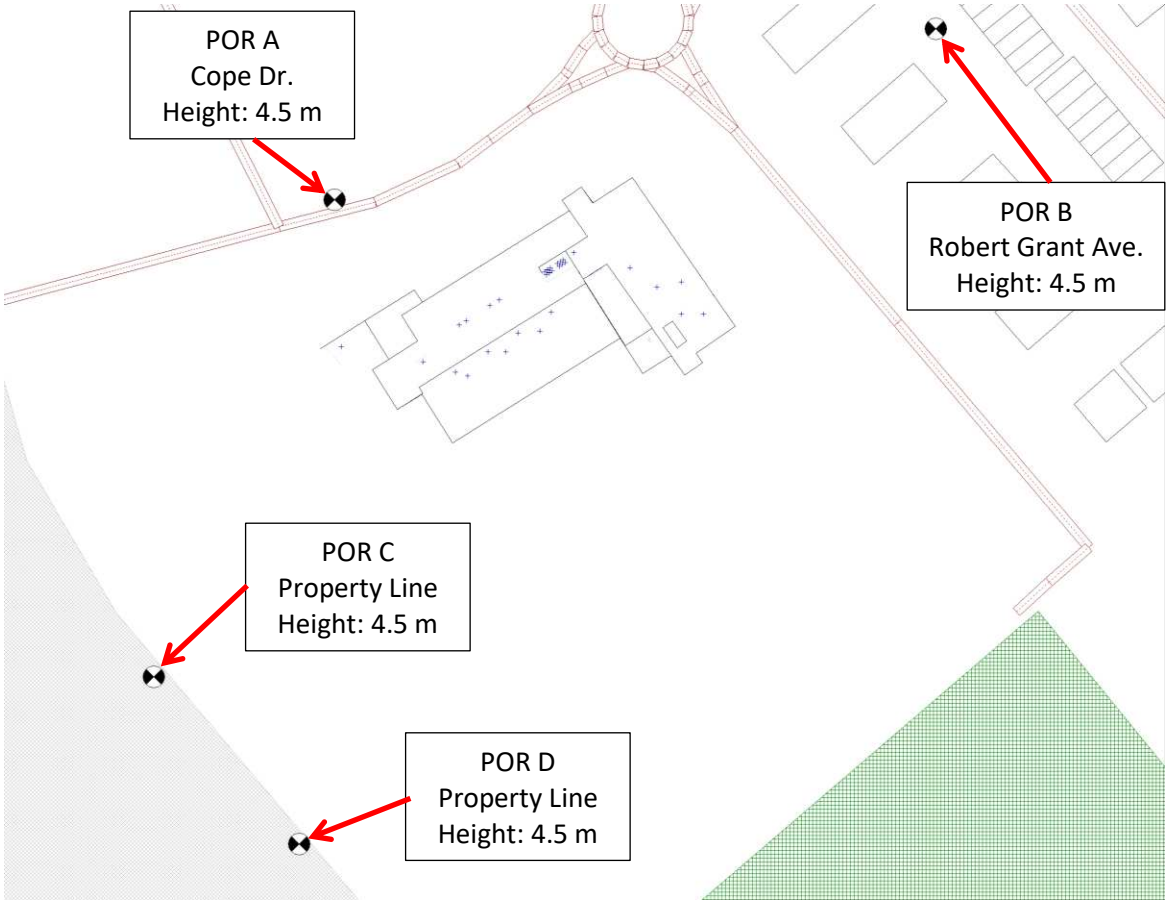


Figure 2.9 – Illustration showing locations and heights of points of reception for stationary noise assessment**.**

2.5 Methodology Used in Environmental Noise Impact Calculation

The following sections describe the methodology and software used to model the sound pressure levels at the points of reception due to the noise sources while considering parameters such as source levels, distance, topography, barriers, and building geometry.

2.5.1 Procedure Used to Assess Noise Impact at Each Point of Reception

This environmental noise analysis was done using an environmental noise modeling software called CadnaA which references ISO 9613. CadnaA predicts environmental noise through calculations based on a 3D model which uses geometrical, landscape, and topographical data, combined with details of the proposed construction and the noise source power levels.

We created a 3D rendering of the neighbourhood around the building and placed the noise sources in the model at the appropriate locations and then and applied the sound power levels described in this report. The colours on the ground and building represent the sound pressure level in that area. Sound power levels per octave band were entered into CadnaA at the source's location and the resulting sound pressure levels were calculated at the points of reception.

2.5.2 Other Parameters/Assumptions Used in Calculations

The following table describes the parameters used in the CadnaA model:

Parameter	Value/Condition
Ground Absorption	Default value of 0
Building Reflections	On
Temperature (°C)	10
Relative Humidity (%)	70

Table 2.3 – Parameters used in CadnaA modeling

2.6 Environmental Noise Levels

This section summarizes the CadnaA noise mapping results. Section 2.6.1 below illustrates the steady state sound pressure levels generated by all the noise sources with the currently selected equipment described above. Section 2.6.2 discusses the recommended noise control measures to reduce the noise to acceptable levels, and Section 2.6.3 shows the results for the predicted noise map with the noise control measures input into the model. The generator is considered for operation during the day but outside of school hours, since testing of the generator during school hours will significantly increase the overall noise levels.

2.6.1 Results with Current Selections

Figure 2.10 shows the noise grid prediction at 4.5 m height and the sound pressure levels predicted at all the PORs with the daytime equipment operating, i.e. during school hours. The generator is off. The City of Ottawa Noise Bylaw and ENCG daytime limit of 50 dBA must be met, which means there should be no red in any current or future residential area. Figure 2.10 shows that the sound pressure levels exceed the daytime limit of 50 dBA at PORs A, C, and D. ERV-1 and the chillers are the main contributors to noise at POR A. For PORs C and D, the chillers are the most significant sources of noise.

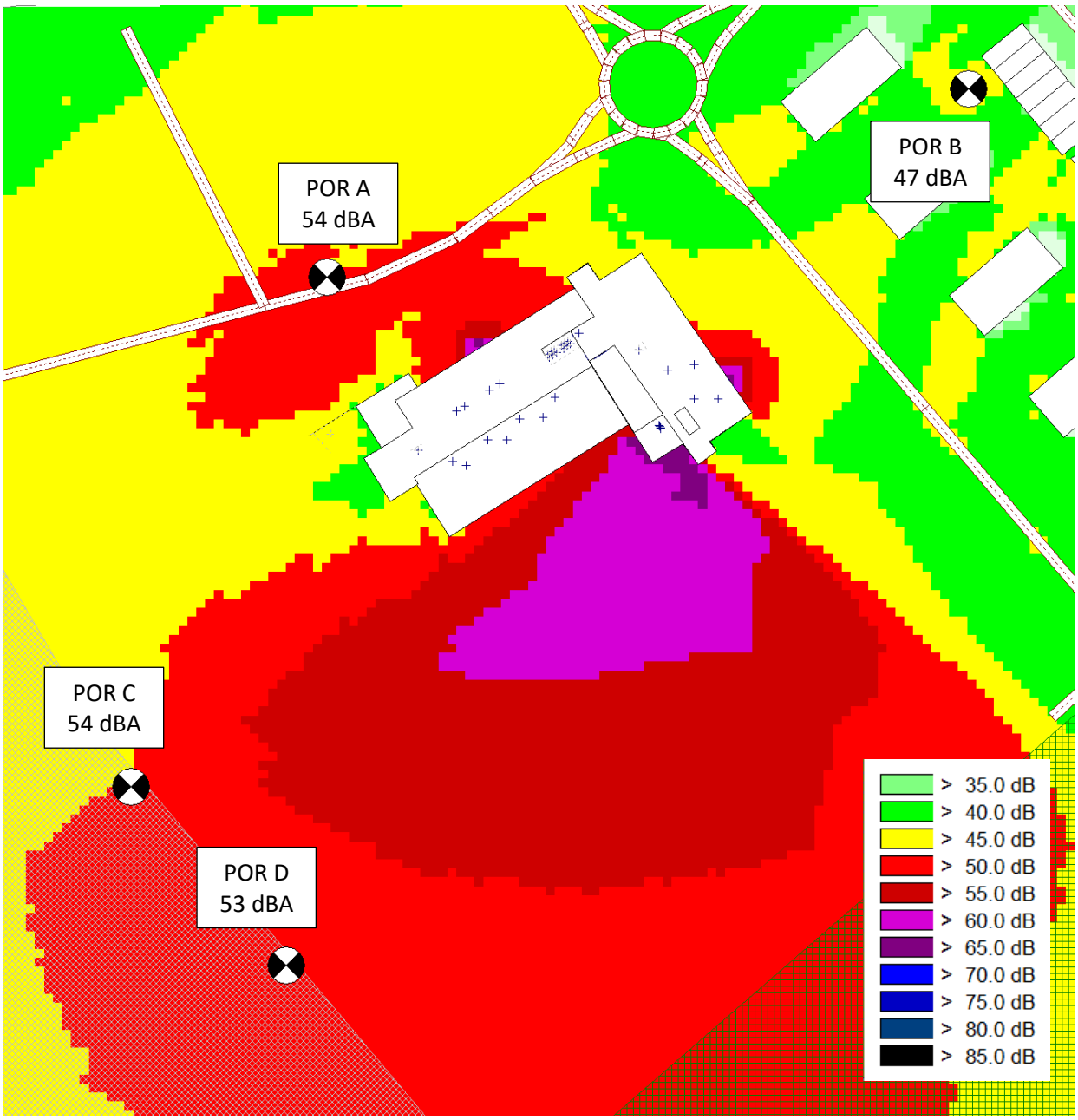


Figure 2.10 – Noise map at 4.5 m height with current equipment selections and barriers for daytime operations, with generator off.

The nighttime noise levels, i.e. with only ERV-1, ERV-2, the condensing units, and exhaust fans EF-1 to EF-4 on, are shown Figure 2.11 with a noise grid at 4.5 m height. The predicted sound pressure levels at the PORs are also shown. To meet the ENCG limit of 45 dBA, there should be no yellow or red in any current or future residential area. POR A and POR B are both above the limit, which is caused by ERV-1 and ERV-2, respectively.

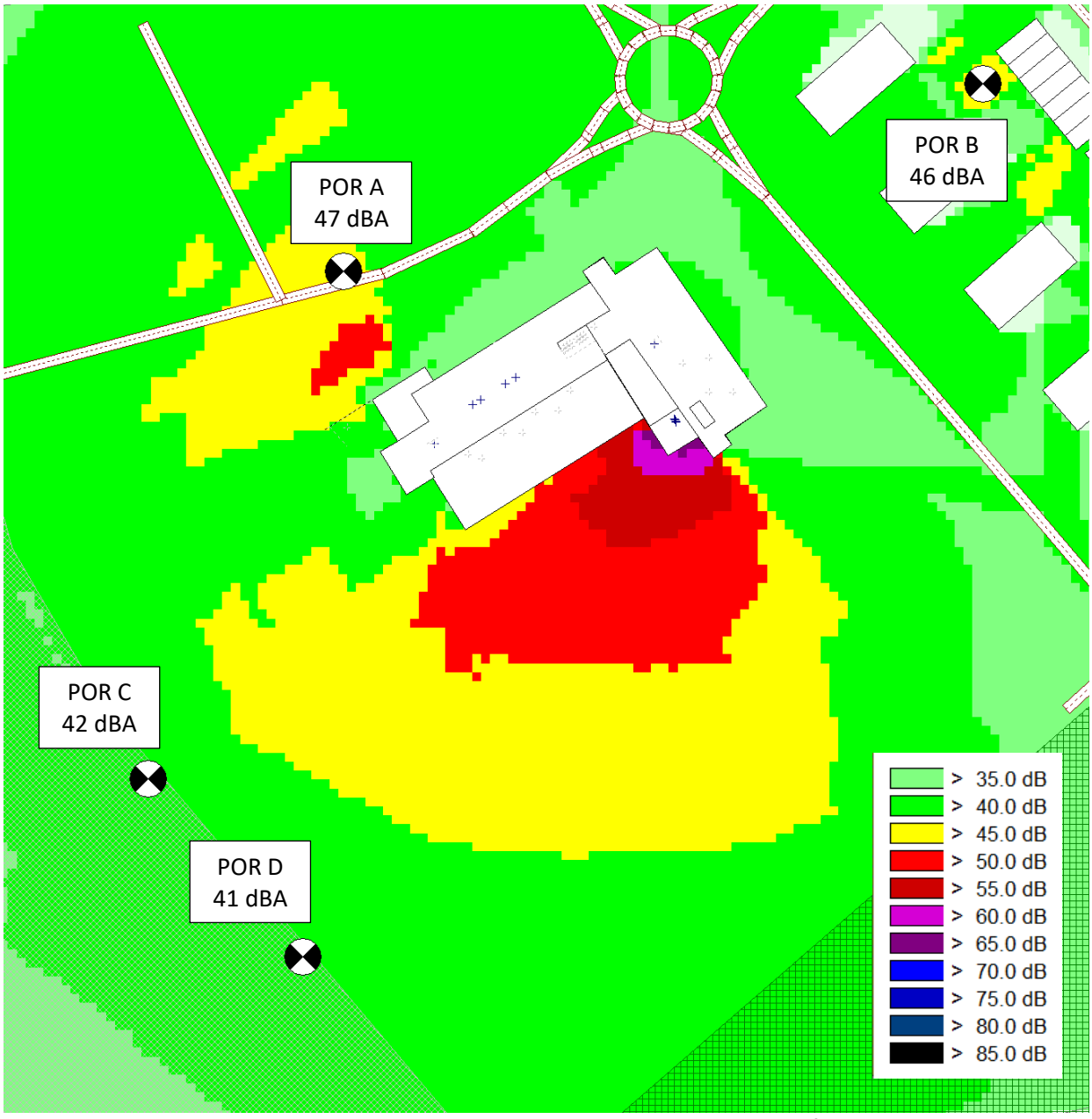


Figure 2.11 – Noise map at 4.5 m height with current equipment selections for nighttime operations, with generator off.

Figure 2.12 below shows the predicted noise map with ERV-1, ERV-2, the condensing units, exhaust fans EF-1 to EF-4, and the generator on. This is based on a scenario where the generator is tested during daytime hours but before school hours begin, i.e. between 7 am and 8 am, whereby the daytime limit of 50 dBA applies. This is considered because it reduces the noise control measures that would be required for generator testing during school hours. The figure shows that this operational schedule constraint for generator testing is insufficient meet the City's noise requirements, since both PORs A and C are above the 50 dBA limit.

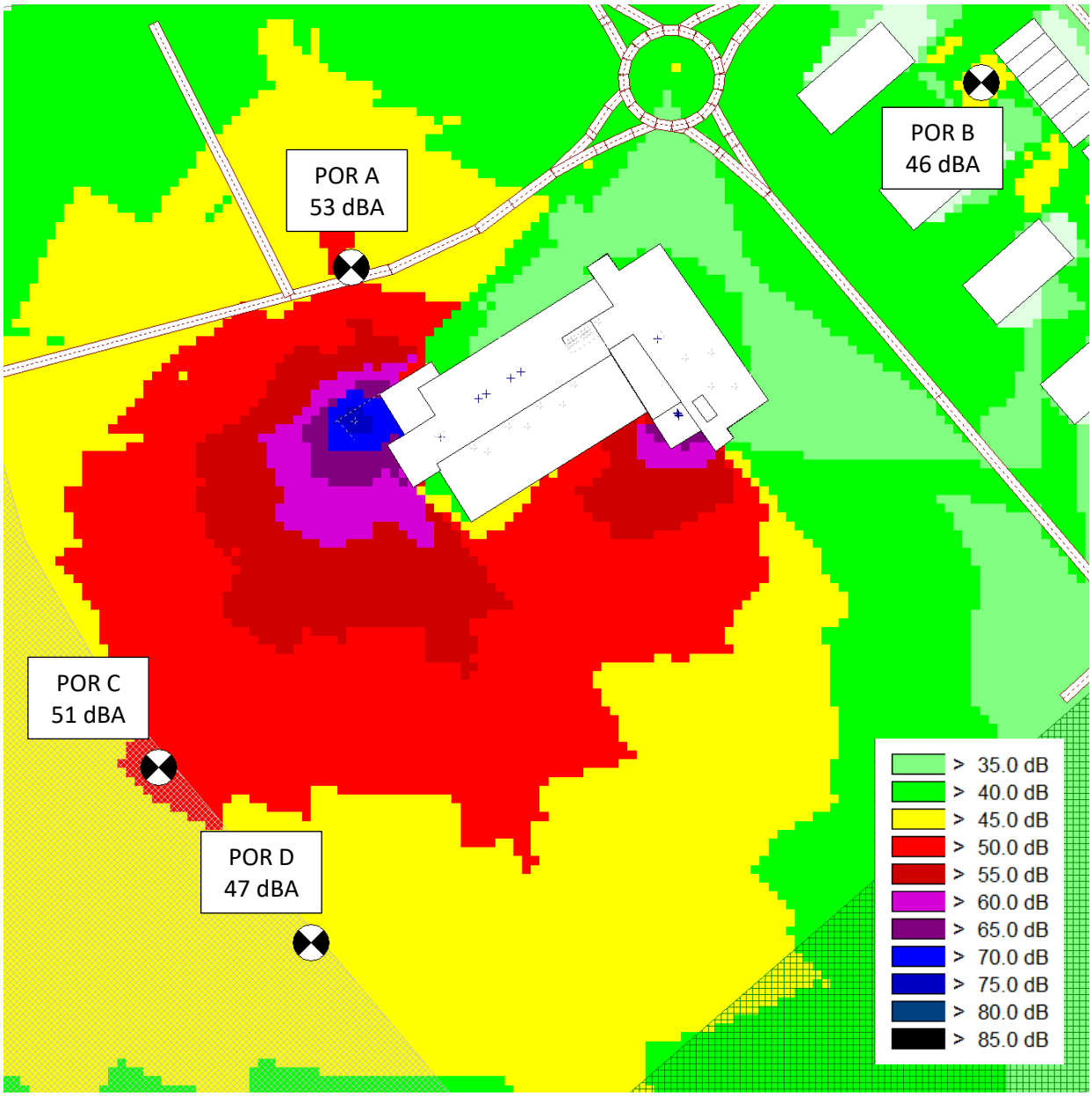


Figure 2.12 – Noise map at 4.5 m height with current equipment selections, for generator testing between 7 am and 8 am.

Figures 2.10 to 2.12 demonstrate that the currently selected equipment will not meet the City's noise requirements. Accordingly, noise control measures are required, as discussed in the following section.

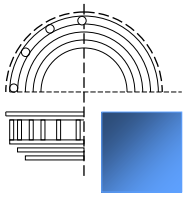
2.6.2 Noise Control Measures and Recommendations

As Section 2.6.1 shows, the generator, chillers, and ERVs are significant contributors to noise levels that exceed the City's limits at nearby residences. This section discusses the recommended measures to reduce the noise emitted from these sources to the required levels. For each unit, it is possible to either utilize a quieter version of the equipment, which can be done by selecting another model with lower noise levels or installing silencers on the current units, or constructing improved acoustic barriers to reduce the noise being transmitted to sensitive areas. This section discusses these options for each piece of equipment.

2.6.2.1 Generator

The currently selected generator and enclosure is rated at 73 dBA SPL at 7 m, which results in noise levels above the 50 dBA daytime limit at PORs A and C. In order to reduce the noise to within acceptable levels, a reduction of 3 dBA overall is needed; the generator and enclosure must be rated at 70 dBA SPL at 7 m to meet the noise requirements with the current barrier. The generator must also be tested during the daytime but outside of school hours.

Alternatively, a generator with the current sound rating of 73 dBA SPL at 7 m can be used in conjunction with an improved acoustic barrier, as shown in Figure 2.13 below. This requires an increase in the height of the 19 m long section from 2.55 m to 3.5 m, as well as the addition of a 9 m long and 3.5 m high barrier section, which may replace the chain link fence at this location in the current site plan. All barriers must be continuous with no openings and have a minimum surface density of 20 kg/m^2.



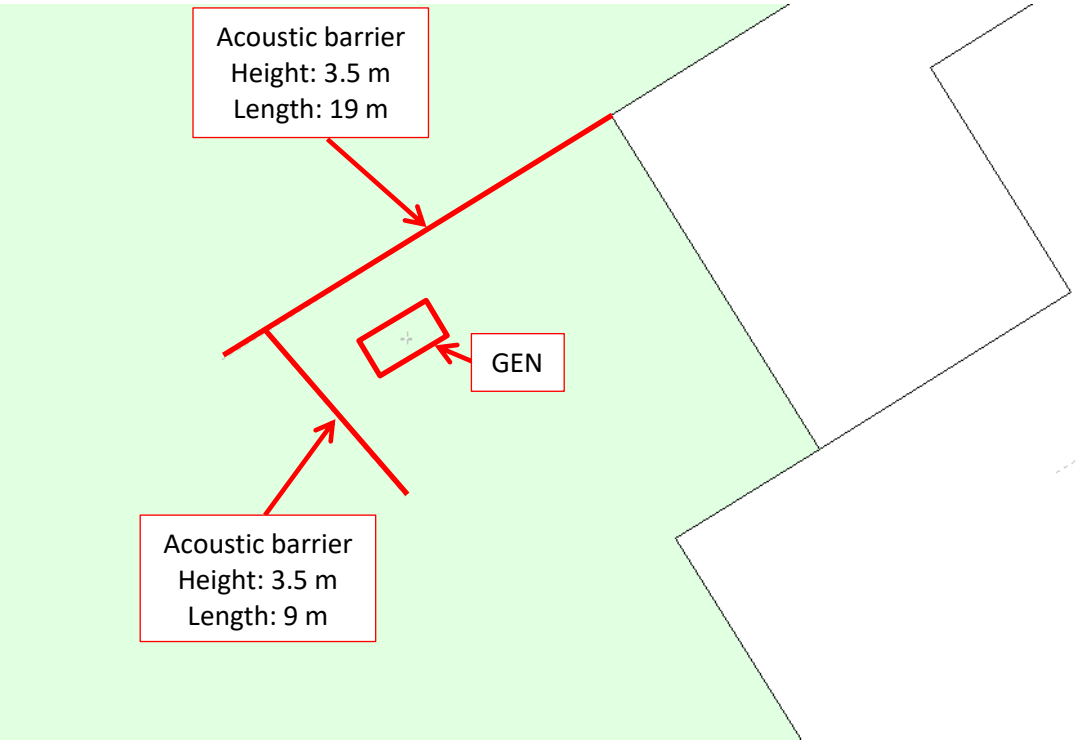


Figure 2.13 – Illustration of recommended acoustic barriers for current generator selection.

In both scenarios, the noise levels are reduced to less than the 50 dBA daytime limit but above the 45 dBA nighttime limit. Therefore, in addition to the required noise measures, the generator must be tested between the hours of 7 am and 8 am, so that it is during daytime hours but before the mechanical equipment needed for school hours is operational.

2.6.2.2 Chillers

The currently selected chillers have an overall sound power level of 99 dBA each, resulting in noise levels above the daytime 50 dBA limit at PORs A, C, and D with the current barrier. To reduce the noise to acceptable levels, the overall sound power should be reduced by 6 dBA to 93 dBA for each chiller. This can be achieved by selecting chillers with quieter operation or installing silencers on the chiller fans that meet this requirement.

Alternatively, an improved sound barrier can be constructed around the currently selected chillers. The current chiller barrier runs along the north side of the chillers and partially along the west side. To reduce the noise to acceptable levels, acoustically absorptive barriers should be constructed so that the chillers are completely encompassed, as shown in Figure 2.14 below. This barrier should be 4.1 m high on the north and west sides of the chillers, and 3.0 m high on the south side. The sides of the barrier facing the chillers should be lined with acoustically absorptive material with an absorption coefficient of at least 0.50, in order to reduce reflections to the surrounding noise sensitive areas. A door to the chiller should be located from the mechanical penthouse, so as not to interrupt the barrier.

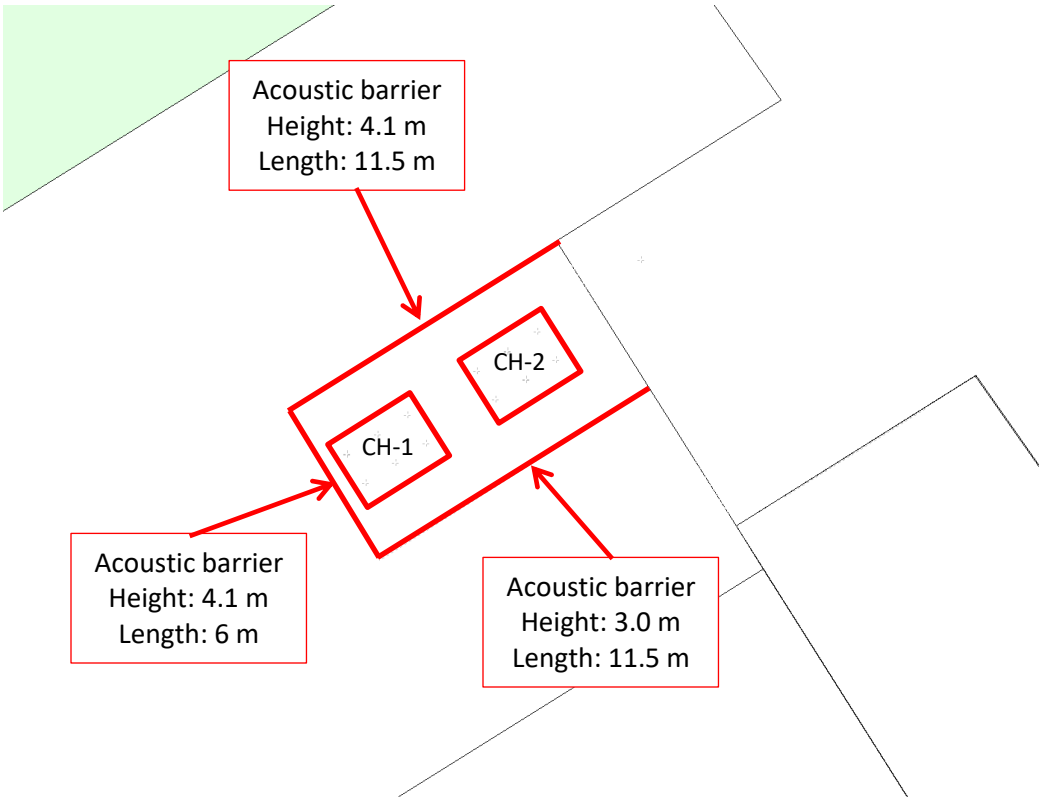


Figure 2.14 – Illustration of recommended acoustic barriers for current chiller selection.

2.6.2.3 ERVs

ERV-1 and ERV-2 cause noise levels above the required limits at POR A and POR B, respectively. We recommend using silencers on the intake and exhaust openings of each of these ERVs, with the required insertion loss values shown in Table 2.4 below. This will reduce the noise levels from the ERVs to acceptable levels for both daytime and nighttime operation.

	Silencer Insertion Loss Requirements (dB)							
	63Hz	**125Hz**	**250Hz**	**500Hz**	**1kHz**	**2kHz**	**4kHz**	**8kHz**
Proposed ERV Silencer	2	2	3	4	4	4	3	2

Table 2.4 – Recommended insertion loss values for ERV-1 and ERV-2 for scenario without ERV barriers.

Alternatively, barriers can be installed on the north side of ERV-1 and east side of ERV-2, as shown in Figure 2.15.

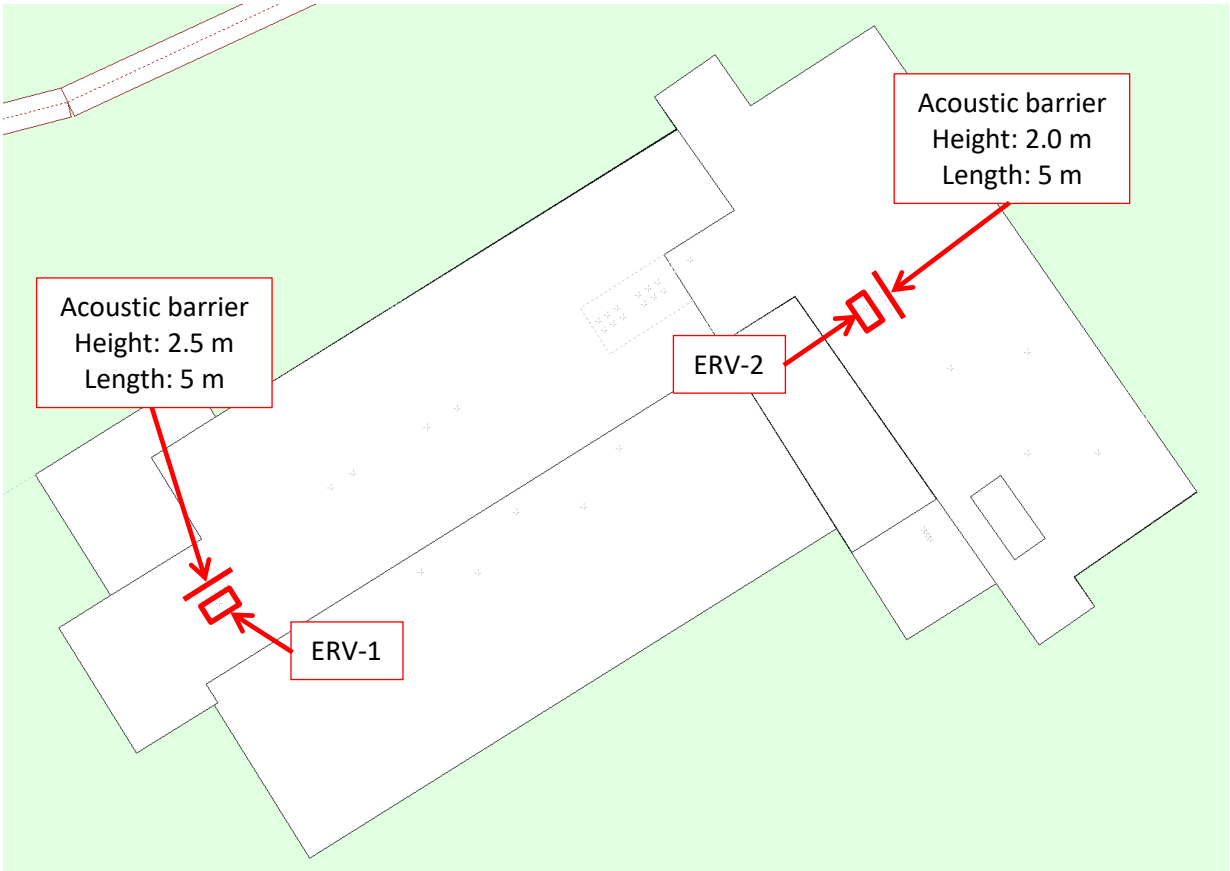


Figure 2.15 – Illustration of recommended acoustic barriers for current ERV-1 and ERV-2 selection.

2.6.3 Results with Noise Control Measures

The noise map was recalculated with the attenuated versions of the equipment (generator at 70 dBA @ 7 m, chillers at 93 dBA overall, ERVs 1 and 2 attenuated per Table 2.4) and current barriers, as discussed in Section 2.6.2. The option for improved acoustic barriers and current equipment selections are not shown here but will also meet the requirements. Figure 2.16 shows the noise grid prediction at 4.5 m elevation for daytime operations (school hours) with the attenuated equipment and the generator off. The noise levels at the PORs are also shown. These results demonstrate that the attenuation measures proposed have effectively reduced the noise to acceptable levels, as there is no red in any residential area and all PORs are below 50 dBA.

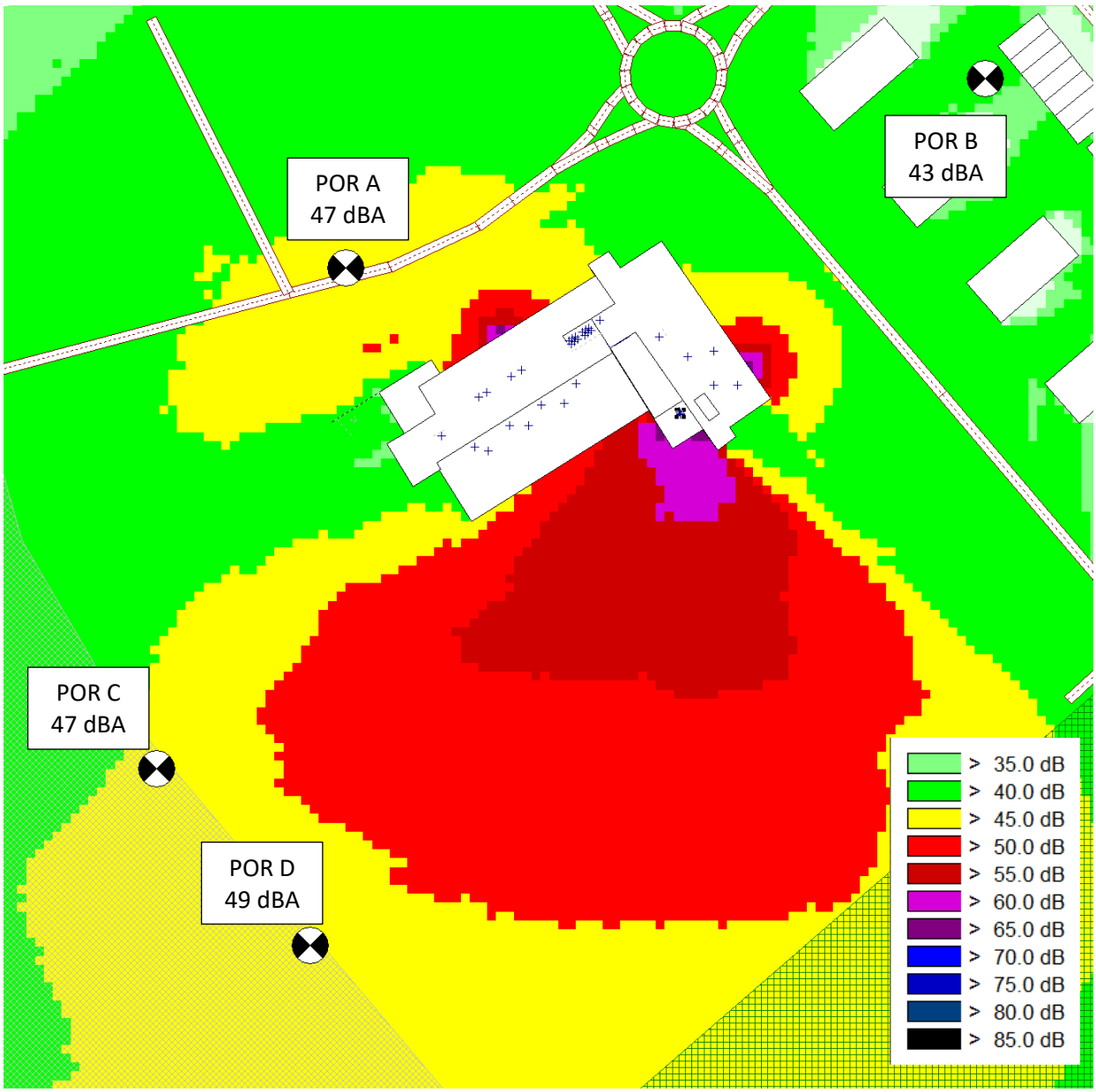


Figure 2.16 - Noise map at 4.5 m height with attenuated equipment selections and current barriers for daytime operations, with generator off.

Figure 2.17 below shows the noise grid prediction at 4.5 m height for nighttime operations with the attenuated equipment and the generator off. All of the PORs are below the 45 dBA limit and there is no red or yellow in any residential area, showing that the attenuation measures satisfy the nighttime noise requirement.

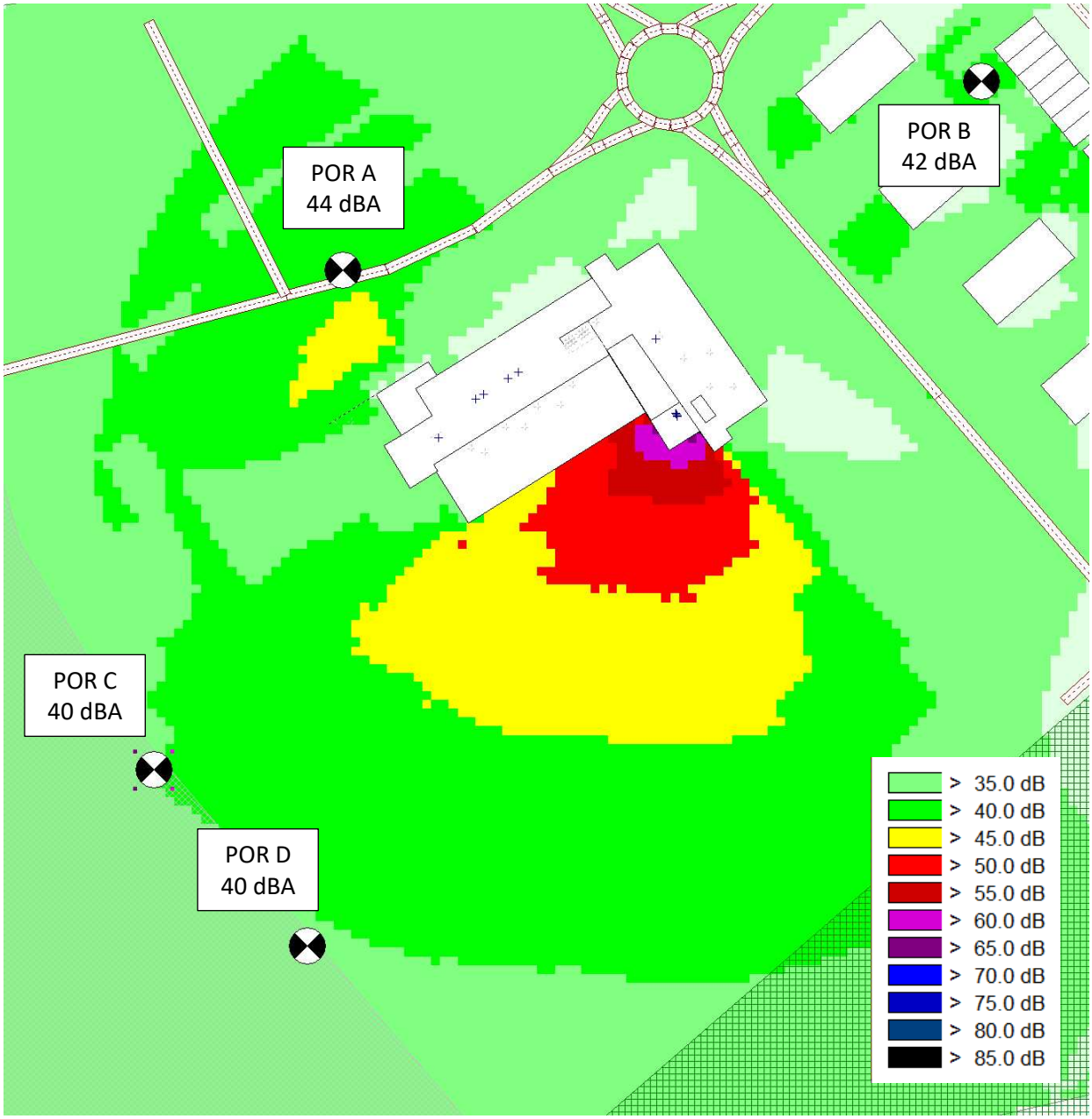


Figure 2.17 – Noise map at 4.5 m height with attenuated equipment selections and current barriers for nighttime operations, with generator off.

The predicted noise map for generator testing between 7 am and 8 am with the attenuated equipment selections is shown in Figure 2.18. The noise levels at all PORs is less than the 50 dBA daytime limit. This shows that restricting the testing of the generator with reduced noise levels to these times will satisfy the noise requirements.

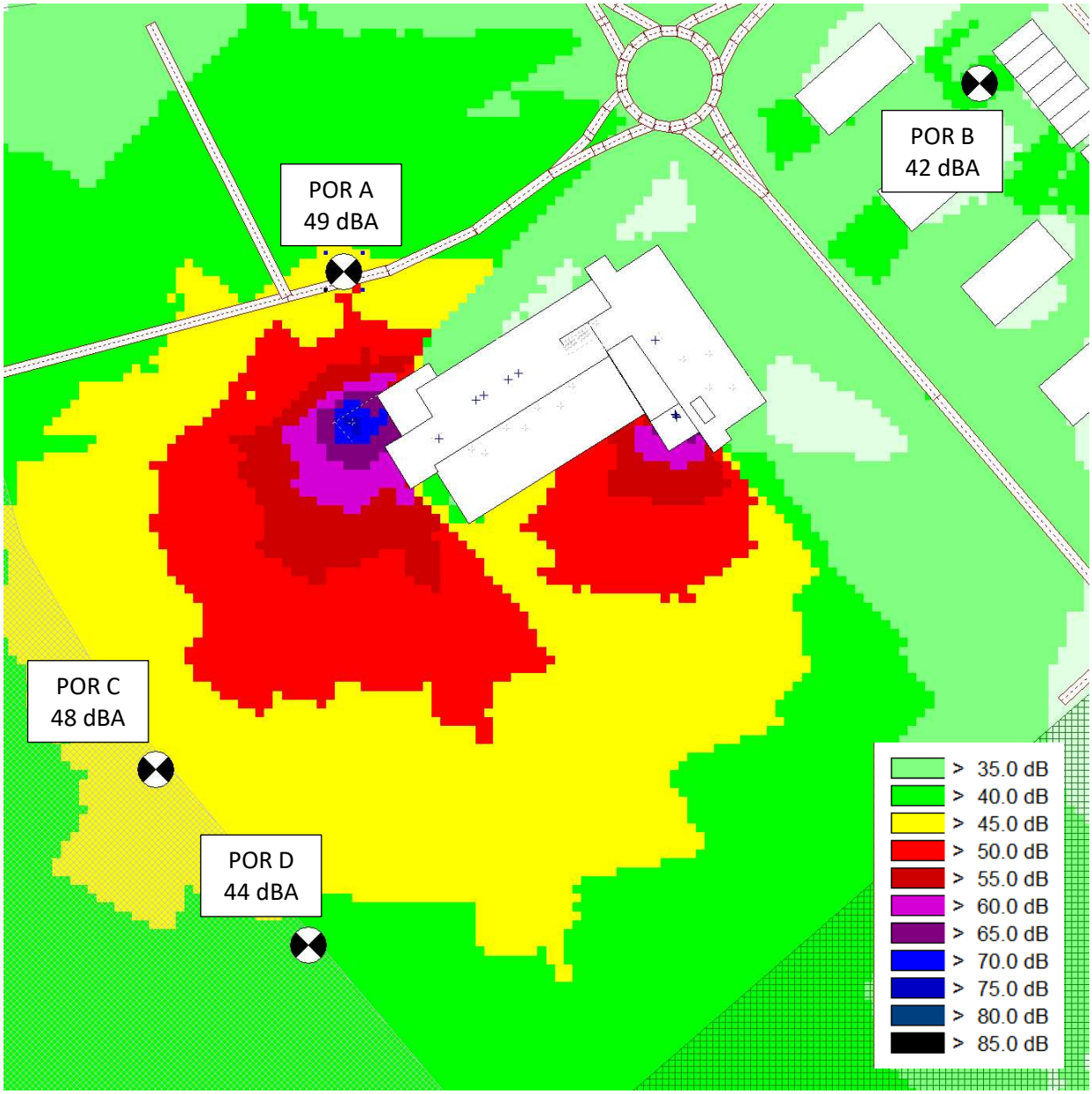


Figure 2.18 – Noise map at 4.5 m height with attenuated equipment selections and current barriers, for generator testing between 7 am and 8 am.

The results demonstrate that attenuated versions of the equipment with the current barriers will satisfy the noise requirements. Similarly, the option to select the current equipment and construct improved barriers, as discussed in Section 2.6.2, also yields results that satisfy the City's noise requirements.

2.7 Environmental Noise Assessment Summary

We have reviewed the sound pressure levels in our 3D acoustical model of the mechanical equipment of the new Stittsville High School in Ottawa, Ontario. We have found that the current mechanical equipment and generator selections exceed the City of Ottawa's noise limits of 50 dBA during the day and 45 dBA at night. Therefore, noise control measures are required for the generator, chillers, and ERVs 1 and 2. This can be achieved by attenuating the units themselves, i.e. by replacing the units with quieter versions and/or the use of silencers, or with the addition of improved acoustic barriers, both of which are discussed in Section 2.6.2. In Section 2.6.3, it is shown that the use of attenuated equipment with current barriers will reduce noise levels to within the acceptable limits. The use of the improved acoustic barriers with the current equipment selection, discussed in Section 2.6.2, was also modelled and will reduce the noise to acceptable levels.

Furthermore, if the ambient noise is expected to be greater than the limits set out in the Bylaw and ENCG, and the equipment selection will not exceed this ambient noise level, it may be possible to operate with equipment that results in noise levels above the 50 dBA daytime and 45 dBA nighttime limits. However, ambient noise levels must be confirmed via 48 hour testing as per the MECP.

3.0 Traffic Noise Study

The following section describes our analysis of the road noise impact on the proposed development at 700 Cope Drive.

3.1 City of Ottawa Environmental Noise Guidelines for Traffic Noise (Road & Rail)

This assessment uses the City of Ottawa - Environmental Noise Control Guidelines (ENCG), dated January 2016, to assess and mitigate noise from roads, transit ways, railways and aircraft. The maximum road and rail noise levels for indoor and outdoor living areas are taken from Table 2.2a, 2.2b and 2.2c of the ENCG and summarized in Table 3.1 below.

Item	Type of Space	Time Period	Required Leq (dBA)	
			Road	Rail
Indoor Living Areas	Living/dining, den areas of residences, hospitals, nursing homes, schools, daycare centres, etc.	07:00 – 23:00	45	40
	Living/dining, den areas of residences, hospitals, nursing homes, etc. (except schools or daycare centres)	23:00 – 07:00	45	40
	Sleeping quarters	07:00 – 23:00	45	40
		23:00 – 07:00	40	35
	General offices, reception areas, retail stores, etc.	16 hours between 07:00 – 23:00	50	45
	Theatres, places of worship, libraries, individual or semi-private offices, conference rooms, reading rooms, etc.	16 hours between 07:00 – 23:00	45	40
	Sleeping quarters of hotels/motels	8 hours between 23:00 – 07:00	45	40
	Sleeping quarters of residences, hospitals, nursing/retirement homes, etc.	8 hours between 23:00 – 07:00	40	35
Outdoor Living Areas	Backyards (single homes min 56m2, semi-detached min 46m2, row housing min 37m2) , balconies (min 4m depth), and common outdoor living areas for multi-storey apartment buildings or condos.	16 hour, 07:00 – 23:00	55	

Table 3.1 – Criteria for Indoor Living Areas and Outdoor Living Areas Road and Rail Noise Levels.

The ENCG states that noise control studies are to be prepared when the noise sensitive development is within the following setback distances from the road, highway and railway noise sources:

- 100m from an arterial road or a major collector, light rail corridor or bus rapid Transitway
- 250m from an existing or proposed highway
- 300m from a proposed or existing rail corridor or secondary main railway line
- 500m from a 400-series provincial highway or principle main railway line

Based on the requirements, a traffic noise study is required, and the school indoor living areas must meet 45 dBA between 07:00 – 23:00. Section 3.2 will detail the traffic noise sources included in the analysis and Section 3.3 will state the points of reception chosen for the school classroom addition.

No rail or aircraft noise sources are required to be part of the traffic noise study.

3.2 Traffic Noise Sources

There are three traffic noise sources within range. These three noise sources are: Cope Drive which is 31 meters away from the school, Robert Grant Avenue and the Transitway, which are both located 38 meters away from the school on the main level and 33 meters away on the second level as shown on Figures 3.1 and 3.2 on the next page. Table 3.2 below summarizes the road parameters which were used in this analysis.

Road	Road Class	Posted Speed	AADT Vehicles/Day	Day/Night Split (%)	Medium Trucks (%)	Heavy Trucks (%)
Robert Grant Avenue	4-Lane Urban Arterial-Divided (4-UAD)	60 km/hr	8750 per lane	92/8	7	5
Cope Drive	2-Lane Major Collector (2-UCU)	40 km/hr	6000 per lane	92/8	7	5
Transitway (On Robert Grant Avenue)	N/A	80 km/hr	480 per lane	92/8	100	0

Table 3.2 – Summary of Major Road Noise Sources.

Data for the Transitway was obtained from “West Transitway: Terry Fox Drive to Fernbank Road Projected Transit and Traffic Volumes at Hazeldean and Maple Grove/N-S Arterial Intersections” by Delcan. Projected peak hour bus volumes were used in our calculations.

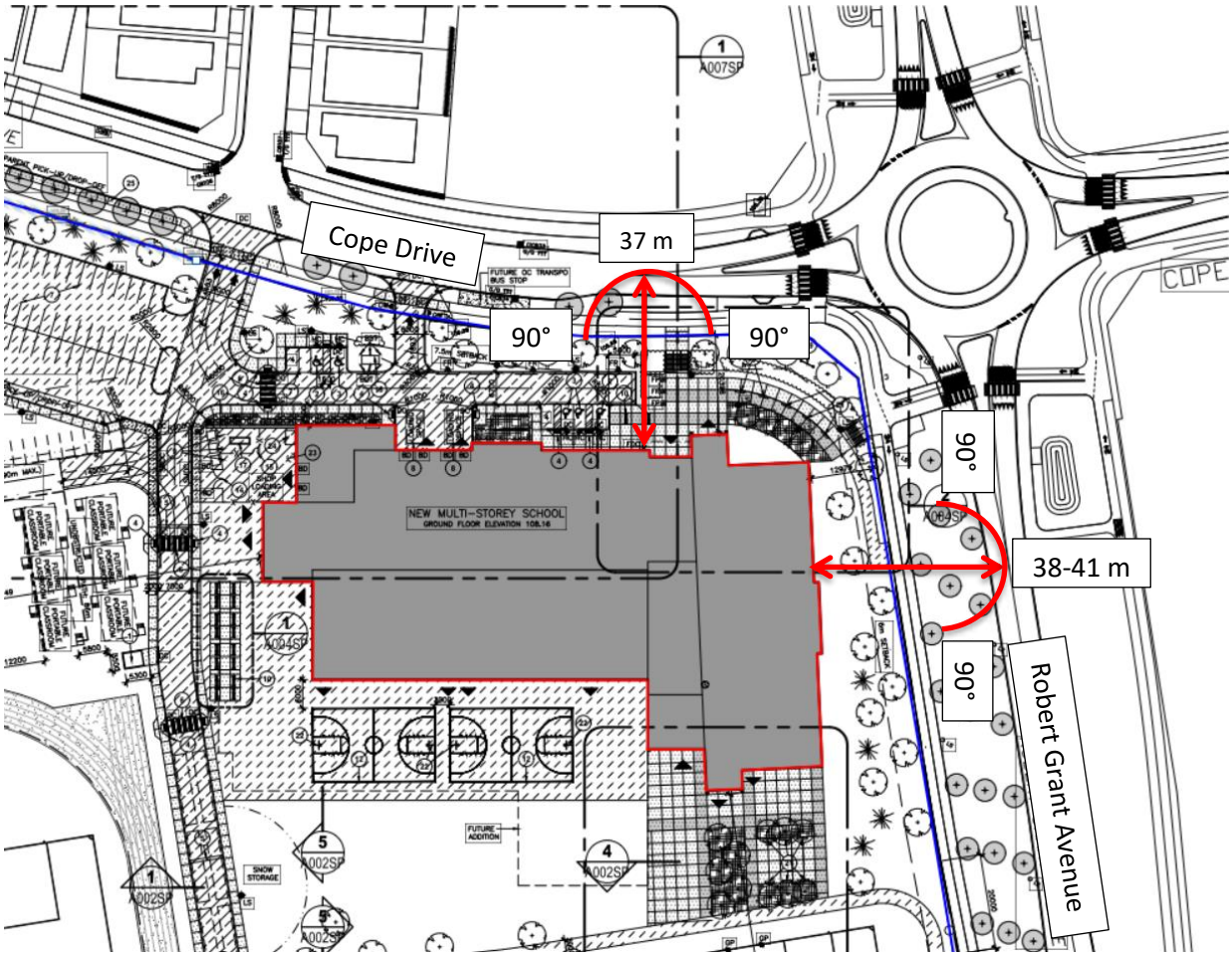


Figure 3.1 – Site plan section of Stittsville High School showing locations and distances of relevant noise sources.

The distances of Stittsville High School from the main road have increased from the previous calculations, as the school is set further back from the roads in the latest plans.

3.3 Points of Reception

To determine the worst-case noise impact on the façade of the building, we have chosen points of reception based on proximity to relevant noise sources, i.e. roads. POR 1 is located at the ground floor classroom closest to Cope Dr., which is 37 m away, and POR 2 is on the first floor classroom closest to Robert Grant Ave., which is 41 m away. On the second floor, POR C is at the classroom closet to Cope Dr., which is 37 m away, and POR 4 faces Robert Grant Ave., which is 38 m away. POR heights are shown in Figure 3.2 and Figure 3.3 on the North and East building elevations, respectively. Figure 3.4 and Figure 3.5 on the next page show the classroom floor plans for PORs A to D. Table 3.3 below summarizes the POR heights, distances to relevant noise sources, and angles to the sources.

Receiver	Height (m)	Noise Source								
		Robert Grant Ave.			Transitway			Cope Dr.		
		Distance from Source (m)	Angle to source from left	Angle to source from right	Distance from Source (m)	Angle to source from left	Angle to source from right	Distance from Source (m)	Angle to source from left	Angle to source from right
POR 1	1.5	71	90	0	71	90	0	37	90	90
POR 2	1.5	41	90	90	41	90	90	75	0	90
POR 3	5.5	67	90	0	67	90	0	37	90	90
POR 4	5.5	38	90	90	38	90	90	43	0	90

Table 3.3 – POR height, distance from noise sources, and angles to noise sources.

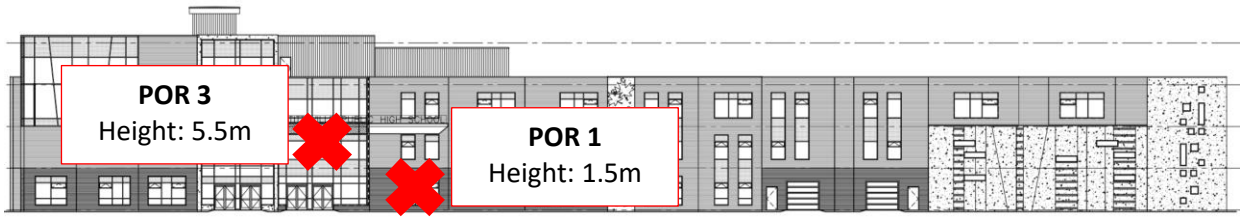


Figure 3.2 – North elevation of Stittsville High School showing location and heights of points of reception.

Figure 3.3 – East elevation of Stittsville High School showing location and heights of points of reception.

There are no outdoor living areas on the high school, therefore there are no outdoor living area points of reception included in our analysis.

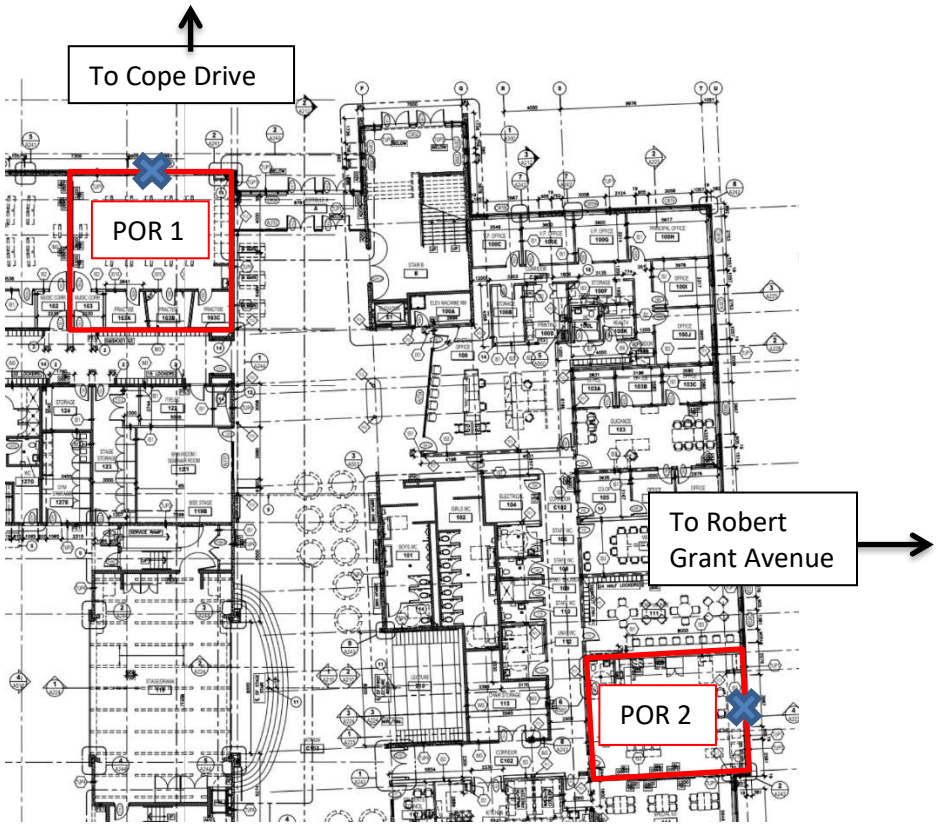


Figure 3.4 – Floor plan section of ground floor (northeast corner) showing the plane of window (POW) points of reception, POR 1 and POR 2

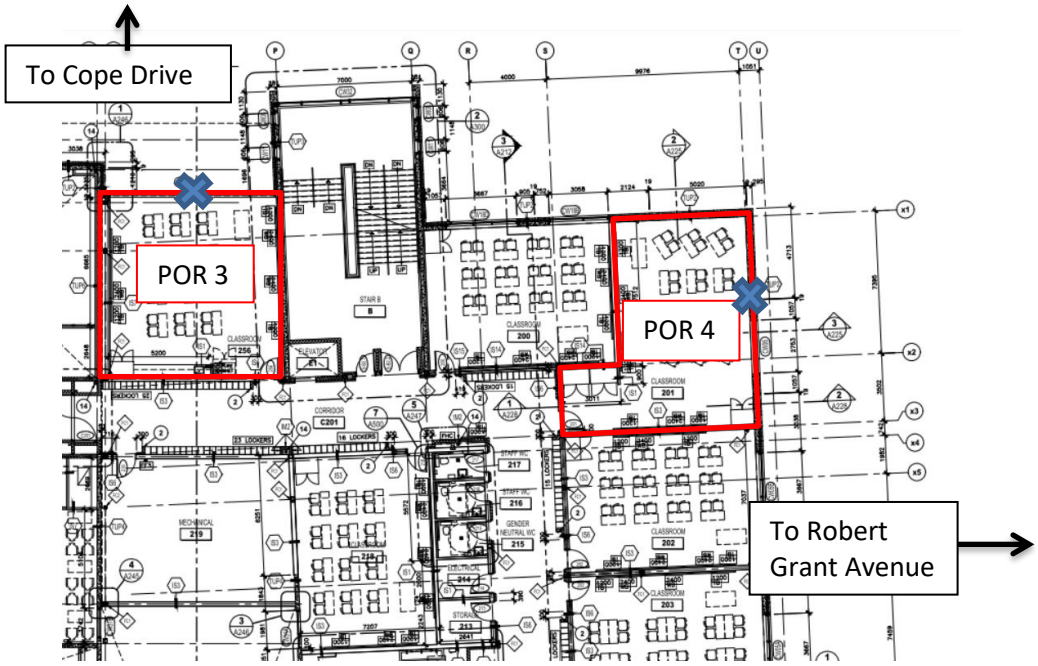


Figure 3.5 – Floor plan section of second floor (northeast corner) showing the plane of window (POW) points of reception, POR 3 and POR 4

3.4 Methodology Used in Traffic Noise Impact Calculation

In order to calculate the road noise impact at the proposed development, we utilized the Ministry of Environment's STAMSON modeling software version 5.04. This program allows us to input variables of a road such as traffic volume, speed, day and night traffic splits, and topography to determine the noise impact at a point of reception.

According to the ENCG, when noise levels could exceed 55 dBA at the Plane of Window (POW) of a classroom area (day), the exterior cladding system of the building envelope must be acoustically designed to ensure the indoor noise criteria is achieved. The City of Ottawa recognizes the Acoustic Insulation Factor (AIF[1]) method as an appropriate analysis technique.

3.4.1 STAMSON Analysis Parameters

The parameters used in STAMSON to assess the noise impact at PORs 1 to 4 are indicated in Table 3.4 below. These are used in conjunction with the parameters for road traffic volume given in Table 3.2 and the angles to the noise sources shown in Table 3.3.

Parameter	Values Used
Roadway	Cope Drive
Time Period	16h
Topography	Flat/gentle slope no barrier
Rows of Houses	0
Intermediate Surface	Reflective
Receiver Height (m)	POR 1: 1.5 m; POR 2: 1.5 m; POR 3: 5.5 m; POR 4: 5.5 m
Source Receiver Distance (m)	POR 1: 37 m; POR 2: 75 m; POR 3: 37 m; POR 4: 43 m

Table 3.3 – Parameters used in the STAMSON model for Cope Dr.

Parameter	Values Used
Roadway	Robert Grant Avenue/ Transitway
Time Period	16h
Topography	Flat/gentle slope no barrier
Rows of Houses	0
Intermediate Surface	Reflective
Receiver Height (m)	POR 1: 1.5 m; POR 2: 1.5 m; POR 3: 5.5 m; POR 4: 5.5 m
Source Receiver Distance (m)	POR 1: 71 m; POR 2: 41 m; POR 3: 67 m; POR 4: 38 m

Table 3.4 – Parameters used in the STAMSON model for Robert Grant Ave. and Transitway.

We have assessed daytime levels only for PORs A to D, as this is a high school in which no one is expected to be in overnight.

3.4.2 Building Component Assessment (AIF Analysis)

To comply with the City of Ottawa policies, the building envelope will require a minimum Acoustic Insulation Factor (AIF) rating to provide the indoor noise level required for living, dining and bedrooms of residential dwellings as described below.

The City of Ottawa's ENCG outlines the following maximum indoor L_{eq} limits:

- maximum daytime indoor L_{eq} for general office space or reception areas should be 50 dBA
- maximum daytime indoor L_{eq} for living areas of schools should be 45 dBA

For the overall exterior wall of any room, the required AIF for road and rail transportation noise is:

Required AIF = Outside L_{eq} - Indoor L_{eq} (Req) + 2dB **(1)**

When the exterior is comprised of components, then the AIF required of each component is determined by the following equation[1]:

Required AIF = Outside L_{eq} - Indoor L_{eq} (Req) + 10 $\log_{10}$ (Number of Components) + 2dB **(2)**

The required AIF is based on the Outside L_{eq}, Indoor L_{eq} required and the total number of exterior façade components. The AIF method allows for the number of components to be reduced if any component significantly exceeds the required AIF[1]:

"If the AIF of any component exceeds the required AIF by 10 or more, the calculation should be repeated for the other components with the 'total number of components' reduced by one. This reduction in the number of components lowers the required AIF for the others."

[1] J.D. Quirt, Building Research Note: Acoustic Insulation Factor: A Rating for the Insulation of Buildings against Outdoor Noise, National Research Council [Revised June 1980]

3.5 Predicted Surface Transportation Noise Levels

Table 3.5 below shows the predicted sound pressure levels at the points of reception from the results of the STAMSON noise software calculation (Appendix A).

Noise Source	POR 1 (dBA)	POR 2 (dBA)	POR 3 (dBA)	POR 4 (dBA)
	Day	Day	Day	Day
Robert Grant Avenue	63.9	69.3	64.2	69.6
Transitway	54.9	60.3	55.2	60.6
Cope Drive	61.8	55.7	61.8	58.1
Sum	**66.3**	**70.0**	**66.5**	**70.4**

Table 3.5 – Predicted traffic noise at the PORs.

We have calculated the predicted noise level caused by traffic using STAMSON and have shown that the 16h L_{eq} for all PORs is above 55dBA, ranging from 66-70dBA. The calculated daytime levels account for a worst-case scenario in terms of traffic noise. As the levels during the day are above 55 dBA the following is required:

1) An evaluation of exterior building components using the AIF method is undertaken in Section 3.6 in order to verify that building components will achieve the required daytime indoor sound level of 45 dBA for classroom-type spaces.
2) Addition of a Warning Clause to the development agreement. The ENGC requires a Warning Clause whenever noise could meet or exceed 55 dBA 16 hour L_{eq} at the Outdoor Living Area or Plane of Window of any living or sleeping area prior to any noise mitigation. General Warning Clause guidelines are provided in Section 3.7.

3.6 Exterior Building Component Analysis (AIF Method)

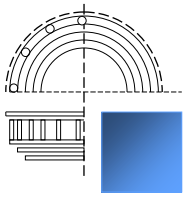
In this section, we determine if the building complies with the City of Ottawa's ENCG indoor noise requirements based on the existing or proposed wall and window construction. We compare the required minimum façade AIF to the estimated AIF of the currently selected façade materials.

3.6.1 Building Components

The current design of the building's façade is made up of 2 different components:

1) Exterior wall
2) Window

The existing exterior wall composition was provided by the architect, as shown in Table 3.6. This wall type is sufficiently similar to wall type EW8 described in the Canada Mortgage and Housing Corporation



(CMHC) document "Road and Rail Noise: Effects on Housing". Table 3.6 shows a comparison of these wall compositions.

Exterior Wall Assembly (TUP1)	**Wall Type EW8 from CMHC Road and Rail Noise**
76.2 mm exterior concrete wythe with 15.9 mm brick facing 101.6 mm rigid insulation 203.2 mm structural concrete wythe	200 mm concrete 25 – 50 mm rigid insulation 12.7 mm gypsum board

Table 3.6 – Comparison of building exterior wall (TUP1) and equivalent wall from CMHC, Road and Rail Noise: Effects on Housing.

There are no glazing assemblies indicated in the architectural drawings and therefore we assume a double pane window that meets the minimum OBC requirements such as the following example:

Basic Window Assembly
3 m glazing 13 mm interplane spacing 3 mm glazing

Table 3.7 – Minimum window assembly specifications required by OBC.

The calculation of AIF for each building component depends on the ratio of the area of a given component of the exterior wall to the total floor area of the corresponding interior room. Using plan view and elevation drawings, we have determined these dimensions for the classroom for which we determined the noise impact at each POR. The layouts of the classrooms are shown in Figure 3.6 to Figure 3.9.

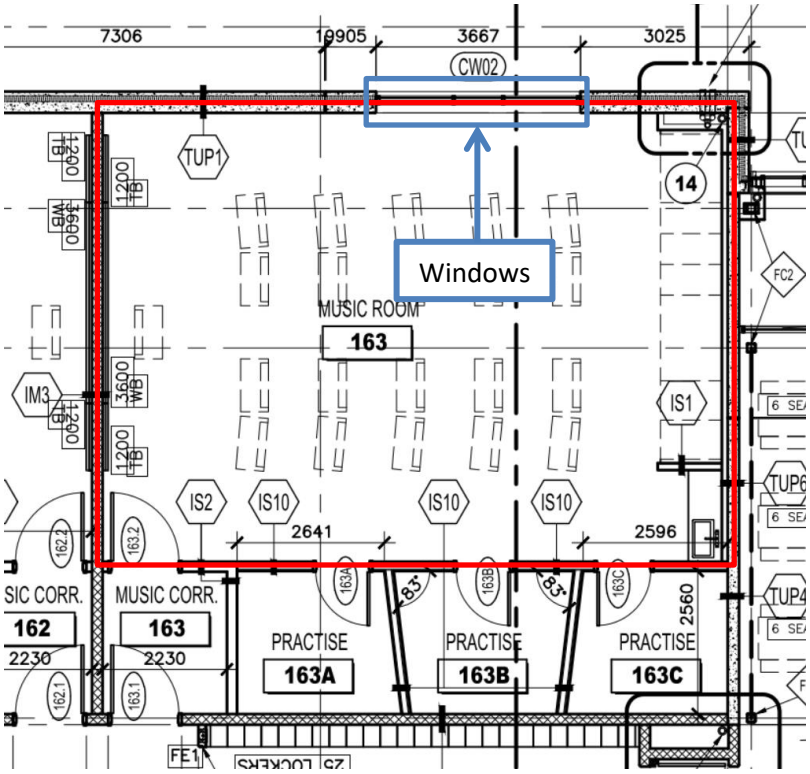


Figure 3.6 – Layout of room 163 used for analysis of POR 1, indicated in red.

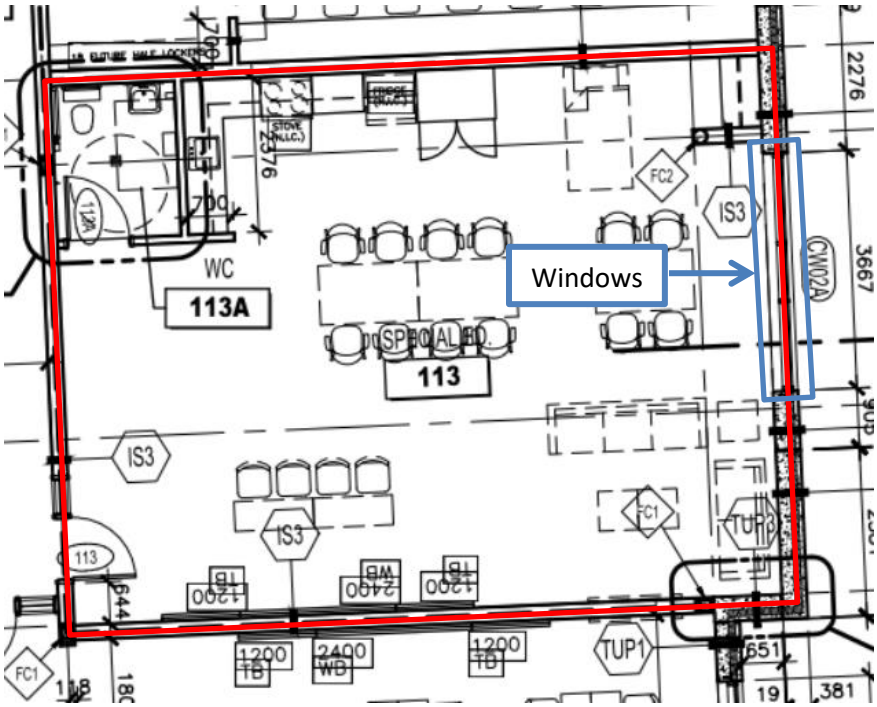


Figure 3.7 – Layout of room 113 used for analysis of POR 2, indicated in red.

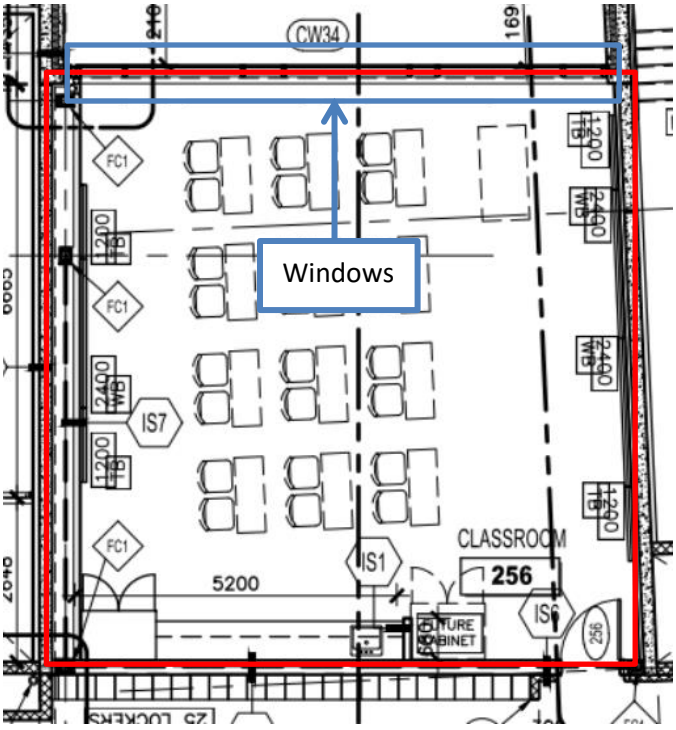


Figure 3.8 – Layout of room 256 used for analysis of POR 3, indicated in red.

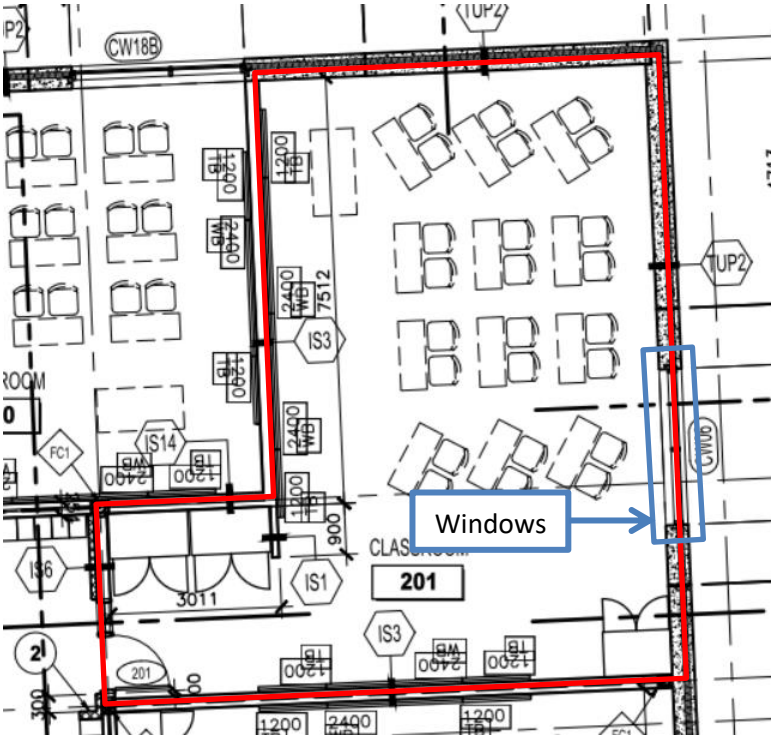


Figure 3.9 – Layout of room 201 used for analysis of POR 4, indicated in red.

3.6.2 AIF Calculations

In Tables 3.8 to 3.11 below, we provide the results of our AIF calculations based on the procedure given in Section 3.4.2, the building component information given in section 3.6.1, and the dimensions from the plans for each component at all PORs. Component AIFs are determined based on component area ratio to floor area given in CMHC "Road and Rail Noise: Effects on Housing" Tables 6.2 and 6.3.

As stated in section 3.4.2, if the AIF of any component exceeds the required AIF by 10 or more (Comp1 AIF > Init AIF +10), the calculation should be repeated for the other components with the 'total number of components' reduced by one. This gives the Final Required AIF for component 2 for which the component AIF is compared to.

POR 1												
Room Floor Area (m^2)	Number of Components	Component Number	Component Type	Component Area (m^2)	Component Area ratio to Floor Area (%)	Outside Leq	Required Indoor Leq	Initial Required AIF	Component AIF	Comp1 AIF > Init AIF +10	Final Required AIF	Acceptable Component AIF
88.0	2	1	Exterior Wall	34.4	39%	66.3	45	26	59	N/A	26	**Yes**
88.0	2	2	Window	9.6	11%	66.3	45	26	34	Yes	23	**Yes**

Table 3.8 – POR 1 AIF parameters used in calculations, resulting required AIF and component AIF, and statement if AIF is acceptable.

POR 2												
Room Floor Area (m^2)	Number of Components	Component Number	Component Type	Component Area (m^2)	Component Area ratio to Floor Area (%)	Outside Leq	Required Indoor Leq	Initial Required AIF	Component AIF	Comp1 AIF > Init AIF +10	Final Required AIF	Acceptable Component AIF
89.0	2	1	Exterior Wall	23.6	27%	70	45	30	61	N/A	30	**Yes**
89.0	2	2	Window	9.6	11%	70	45	30	34	Yes	27	**Yes**

Table 3.9 – POR 2 AIF parameters used in calculations, resulting required AIF and component AIF, and statement if AIF is acceptable.

POR 3												
Room Floor Area (m^2)	Number of Components	Component Number	Component Type	Component Area (m^2)	Component Area ratio to Floor Area (%)	Outside Leq	Required Indoor Leq	Initial Required AIF	Component AIF	Comp1 AIF > Init AIF +10	Final Required AIF	Acceptable Component AIF
81.0	1	1	Window	34	42%	66.5	45	24	28	N/A	24	**Yes**

Table 3.10 – POR 3 AIF parameters used in calculations, resulting required AIF and component AIF, and statement if AIF is acceptable.

POR 4												
Room Floor Area (m^2)	**Number of Components**	**Component Number**	**Component Type**	**Component Area (m^2)**	**Component Area ratio to Floor Area (%)**	**Outside Leq**	**Required Indoor Leq**	**Initial Required AIF**	**Component AIF**	**Comp1 AIF > Init AIF +10**	**Final Required AIF**	**Acceptable Component AIF**
80.0	2	1	Exterior Wall	63.8	80%	70.4	45	30	56	N/A	30	**Yes**
80.0	2	2	Window	6.2	8%	70.4	45	30	35	Yes	27	**Yes**

Table 3.11 – POR 4 AIF parameters used in calculations, resulting required AIF and component AIF, and statement if AIF is acceptable.

All components have acceptable AIFs for all PORs. No changes are required to the exterior façade.

3.7 Warning Clauses

Since the predicted noise level from surface transportation exceeds 55 dBA, a generic warning clause must be added to the development agreement.

The City of Ottawa requires a Warning Clause whenever noise could meet or exceed 55 dBA 16 hour Leq at the Outdoor Living Area or Plane of Window of any living or sleeping area prior to any noise mitigation.

Table 3.6 provides the types of warning clauses and example text to be adapted into warning clauses. These warning clauses should be taken as *example only* and are taken from Appendix A of the ENCG which also states:
"*A warning clause is not considered a form of noise mitigation. It is not acceptable therefore to use warning clauses in place of physical noise control measures to identify an excess over the MOE or City noise limits*."

TYPE	Example Text	Notes
Generic	Purchasers/tenants are advised that sound levels due to increasing road/rail/Light Rail/transit way traffic may occasionally interfere with some outdoor activities as the sound levels may exceed the sound level limits of the City and the Ministry of the Environment. To help address the need for sound attenuation this development has been designed so as to provide an indoor environment that is within provincial guidelines. Measures for sound attenuation include: • multi-pane glass; • brick veneer; • concrete panels;	The generic warning clause outlines that MOE sound levels may be exceeded but the indoor environment is within guidelines. Mitigation measures are described including urban design features. Mention is also made of landscaping to screen the development visually from the source of noise.
Extensive mitigation of indoor and outdoor amenity area	"Purchasers/tenants are advised that despite the inclusion of noise control features in the development and within the building units, sound levels due to increasing road/rail/Light Rail/transitway traffic may, on occasion, interfere with some activities of the dwelling occupants as the sound levels exceed the sound level limits of the City and the Ministry of the Environment. To help address the need for sound attenuation this development may include: • multi-pane glass; • brick veneer; • construction of a solid fence in backyard area To ensure that provincial sound level limits are not exceeded it is important to maintain these sound attenuation features. This dwelling unit has also been designed with the provision	The warning clause makes reference to MOE sound levels being exceeded from time to time and that there are sound attenuation features and landscaping within the development that should be maintained.

	for adding central air conditioning at the occupant's discretion. Installation of central air conditioning will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the sound level limits of the City and the Ministry of the Environment.	
No outdoor amenity area	Purchasers/tenants are advised that sound levels due to increasing road/rail/Light Rail/transitway traffic will interfere with outdoor activities as the sound levels exceed the sound level limits of the City and the Ministry of the Environment. To help address the need for sound attenuation this development may includes • multi-pane glass; • brick veneer; • construction of a solid fence in backyard area To ensure that provincial sound level limits are not exceeded it is important to maintain these sound attenuation features. This dwelling unit has been supplied with a central air conditioning system and other measures which will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the sound level limits of the City and the Ministry of the Environment.	This warning clause notes that only an indoor environment is being provided for.

Table 3.6 – Warning Clause Types and Example Text from the City of Ottawa (from ENCG Table A1)

3.8 Roadway Noise Summary

We have calculated the predicted noise level caused by traffic using STAMSON and have shown that the 16h L_{eq} at:

- POR 1, the point of reception of the closest classroom to Cope Drive on the first story of the northern face of the building, is 66.3 dBA.
- POR 2, the point of reception of the closest classroom to Robert Grant Avenue on the first story of the eastern face of the building, is 70.0 dBA.
- POR 3, the point of reception of the closest classroom to Cope Drive on the second story of the northern face of the building, is 66.5 dBA.
- POR 4, the point of reception of the closest classroom to Robert Grant Avenue on the second story of the eastern face of the building, is 70.4 dBA.

Since the noise levels are above 55 dBA, an evaluation of the exterior building components was performed using the AIF method. Based on the predicted noise levels at the POW, the information provided by the architect regarding the exterior wall type, and the minimum requirements for windows in the OBC, we have determined that the current building components comply with the ENCG requirements for indoor noise level. As such, no changes are required to the exterior building components. Since the predicted noise level from surface transportation exceeds 55 dBA, a generic warning clause must be added to the development agreement.

4.0 Conclusion

For the stationary noise study, we have reviewed the sound pressure levels in our 3D acoustical model of the new mechanical equipment and generator from the new Stittsville High School in Ottawa, Ontario. We have found that given the current mechanical and generator equipment selections, the noise levels exceed the City of Ottawa daytime limit of 50 dBA and nighttime limit of 45 dBA. Noise control measures are therefore required for the generator, chillers, and ERVs 1 and 2, and involve either the selection of quieter equipment or the use of improved acoustic barriers, as discussed in Section 2.6.2. The results for the recalculated acoustical model with the noise control measures implemented show that both approaches reduce the noise to acceptable levels.

The traffic noise from Cope Drive, Robert Grant Avenue, and the Transitway was also analyzed. It was found that the traffic noise from these sources was greater than 55 dBA at the nearest planes of window and warranted an AIF analysis of the exterior building components. This analysis showed that the planned exterior wall assembly and minimum glazing requirements shown in Section 3.6 are acceptable to meet the City of Ottawa ENCG indoor noise requirements. No changes are required.

Should you have any comments or questions regarding this report, please do not hesitate to communicate with us.

Sincerely,

Jessica Kyoz, P.Eng.
Acoustic Consultant

Karim Sachedina, M.A.Sc.
Acoustic Consultant

Approved By:

Donald Buchan, P.Eng
Principal
Buchan Lawton Parent Ltd.

APPENDIX

STAMSON Calculations
Noise Source Sound Data

STAMSON 5.0 NORMAL REPORT Date: 27-11-2019 08:37:57
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 700cope1.te Time Period: Day/Night 16/8 hours
Description:

Road data, segment # 1: Cope Drive (day/night)

Car traffic volume : 9715/845 veh/TimePeriod *
Medium truck volume : 773/67 veh/TimePeriod *
Heavy truck volume : 552/48 veh/TimePeriod *
Posted speed limit : 40 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 12000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 10.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: Cope Drive (day/night)

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 37.00 / 15.00 m
Receiver height : 1.50 / 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Road data, segment # 2: Robert Grant (day/night)

Car traffic volume : 28336/2464 veh/TimePeriod *
Medium truck volume : 2254/196 veh/TimePeriod *
Heavy truck volume : 1610/140 veh/TimePeriod *
Posted speed limit : 60 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)
* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 35000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 10.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 2: Robert Grant (day/night)

Angle1 Angle2 : -90.00 deg 0.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 71.00 / 71.00 m
Receiver height : 1.50 / 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Road data, segment # 3: Transitway (day/night)

Car traffic volume : 0/0 veh/TimePeriod *
Medium truck volume : 641/320 veh/TimePeriod *
Heavy truck volume : 0/0 veh/TimePeriod *
Posted speed limit : 80 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 961
Percentage of Annual Growth : 0.00
Number of Years of Growth : 10.00
Medium Truck % of Total Volume : 100.00
Heavy Truck % of Total Volume : 0.00
Day (16 hrs) % of Total Volume : 66.67

Data for Segment # 3: Transitway (day/night)

Angle1 Angle2 : -90.00 deg 0.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 71.00 / 71.00 m
Receiver height : 1.50 / 4.50 m

Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Cope Drive (day)

Source height = 1.50 m

ROAD (0.00 + 61.80 + 0.00) = 61.80 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	65.72	0.00	-3.92	0.00	0.00	0.00	0.00	61.80

Segment Leq : 61.80 dBA

Results segment # 2: Robert Grant (day)

Source height = 1.50 m

ROAD (0.00 + 63.91 + 0.00) = 63.91 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	0	0.00	73.68	0.00	-6.75	-3.01	0.00	0.00	0.00	63.91

Segment Leq : 63.91 dBA

Results segment # 3: Transitway (day)

Source height = 0.50 m

ROAD (0.00 + 54.91 + 0.00) = 54.91 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	0	0.00	64.67	0.00	-6.75	-3.01	0.00	0.00	0.00	54.91

Segment Leq : 54.91 dBA
Total Leq All Segments: 66.32 dBA

STAMSON 5.0 NORMAL REPORT Date: 27-11-2019 08:39:21
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 700cope2.te Time Period: Day/Night 16/8 hours
Description:

Road data, segment # 1: Transitway (day/night)

Car traffic volume : 0/0 veh/TimePeriod *
Medium truck volume : 641/320 veh/TimePeriod *
Heavy truck volume : 0/0 veh/TimePeriod *
Posted speed limit : 80 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 961
Percentage of Annual Growth : 0.00
Number of Years of Growth : 10.00
Medium Truck % of Total Volume : 100.00
Heavy Truck % of Total Volume : 0.00
Day (16 hrs) % of Total Volume : 66.67

Data for Segment # 1: Transitway (day/night)

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 41.00 / 15.00 m
Receiver height : 1.50 / 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Road data, segment # 2: Robert Grant (day/night)

Car traffic volume : 28336/2464 veh/TimePeriod *
Medium truck volume : 2254/196 veh/TimePeriod *
Heavy truck volume : 1610/140 veh/TimePeriod *
Posted speed limit : 60 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)
* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 35000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 10.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 2: Robert Grant (day/night)

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 41.00 / 15.00 m
Receiver height : 1.50 / 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Road data, segment # 3: Cope Drive (day/night)

Car traffic volume : 9715/845 veh/TimePeriod *
Medium truck volume : 773/67 veh/TimePeriod *
Heavy truck volume : 552/48 veh/TimePeriod *
Posted speed limit : 40 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 12000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 10.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 3: Cope Drive (day/night)

Angle1 Angle2 : 0.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 75.00 / 75.00 m
Receiver height : 1.50 / 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)

Reference angle : 0.00

Results segment # 1: Transitway (day)

Source height = 0.50 m

ROAD (0.00 + 60.31 + 0.00) = 60.31 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	64.67	0.00	-4.37	0.00	0.00	0.00	0.00	60.31

Segment Leq : 60.31 dBA

Results segment # 2: Robert Grant (day)

Source height = 1.50 m

ROAD (0.00 + 69.31 + 0.00) = 69.31 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	73.68	0.00	-4.37	0.00	0.00	0.00	0.00	69.31

Segment Leq : 69.31 dBA

Results segment # 3: Cope Drive (day)

Source height = 1.50 m

ROAD (0.00 + 55.72 + 0.00) = 55.72 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.00	65.72	0.00	-6.99	-3.01	0.00	0.00	0.00	55.72

Segment Leq : 55.72 dBA
Total Leq All Segments: 69.99 dBA

STAMSON 5.0 NORMAL REPORT Date: 27-11-2019 08:40:58
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 700cope3.te Time Period: Day/Night 16/8 hours
Description:

Road data, segment # 1: Cope Drive (day/night)

Car traffic volume : 9715/845 veh/TimePeriod
Medium truck volume : 773/67 veh/TimePeriod
Heavy truck volume : 552/48 veh/TimePeriod
Posted speed limit : 40 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Cope Drive (day/night)

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 37.00 / 15.00 m
Receiver height : 5.50 / 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Road data, segment # 2: Robert Grant (day/night)

Car traffic volume : 28336/2464 veh/TimePeriod *
Medium truck volume : 2254/196 veh/TimePeriod *
Heavy truck volume : 1610/140 veh/TimePeriod *
Posted speed limit : 60 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 35000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 10.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 2: Robert Grant (day/night)

Angle1 Angle2 : -90.00 deg 0.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 67.00 / 67.00 m
Receiver height : 5.50 / 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Road data, segment # 3: Transitway (day/night)

Car traffic volume : 0/0 veh/TimePeriod *
Medium truck volume : 641/320 veh/TimePeriod *
Heavy truck volume : 0/0 veh/TimePeriod *
Posted speed limit : 80 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 961
Percentage of Annual Growth : 0.00
Number of Years of Growth : 10.00
Medium Truck % of Total Volume : 100.00
Heavy Truck % of Total Volume : 0.00
Day (16 hrs) % of Total Volume : 66.67

Data for Segment # 3: Transitway (day/night)

Angle1 Angle2 : -90.00 deg 0.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 67.00 / 67.00 m
Receiver height : 5.50 / 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Cope Drive (day)

Source height = 1.50 m

ROAD (0.00 + 61.80 + 0.00) = 61.80 dBA

Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-90 90 0.00 65.72 0.00 -3.92 0.00 0.00 0.00 0.00 61.80

Segment Leq : 61.80 dBA

Results segment # 2: Robert Grant (day)

Source height = 1.50 m

ROAD (0.00 + 64.17 + 0.00) = 64.17 dBA
Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-90 0 0.00 73.68 0.00 -6.50 -3.01 0.00 0.00 0.00 64.17

Segment Leq : 64.17 dBA

Results segment # 3: Transitway (day)

Source height = 0.50 m

ROAD (0.00 + 55.16 + 0.00) = 55.16 dBA
Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-90 0 0.00 64.67 0.00 -6.50 -3.01 0.00 0.00 0.00 55.16

Segment Leq : 55.16 dBA

Total Leq All Segments: 66.49 dBA

STAMSON 5.0 NORMAL REPORT Date: 27-11-2019 08:32:31
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 700cope4.te Time Period: Day/Night 16/8 hours
Description:

Road data, segment # 1: Transitway (day/night)

Car traffic volume : 0/0 veh/TimePeriod *
Medium truck volume : 641/320 veh/TimePeriod *
Heavy truck volume : 0/0 veh/TimePeriod *
Posted speed limit : 80 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 961
Percentage of Annual Growth : 0.00
Number of Years of Growth : 10.00
Medium Truck % of Total Volume : 100.00
Heavy Truck % of Total Volume : 0.00
Day (16 hrs) % of Total Volume : 66.67

Data for Segment # 1: Transitway (day/night)

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 38.00 / 15.00 m
Receiver height : 5.50 / 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Road data, segment # 2: Robert Grant (day/night)

Car traffic volume : 28336/2464 veh/TimePeriod *
Medium truck volume : 2254/196 veh/TimePeriod *
Heavy truck volume : 1610/140 veh/TimePeriod *
Posted speed limit : 60 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)
* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 35000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 10.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 2: Robert Grant (day/night)

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 38.00 / 15.00 m
Receiver height : 5.50 / 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Road data, segment # 3: Cope Drive (day/night)

Car traffic volume : 9715/845 veh/TimePeriod *
Medium truck volume : 773/67 veh/TimePeriod *
Heavy truck volume : 552/48 veh/TimePeriod *
Posted speed limit : 40 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 12000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 10.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 3: Cope Drive (day/night)

Angle1 Angle2 : 0.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 43.00 / 43.00 m
Receiver height : 5.50 / 4.50 m

Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Transitway (day)

Source height = 0.50 m

ROAD (0.00 + 60.64 + 0.00) = 60.64 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	64.67	0.00	-4.04	0.00	0.00	0.00	0.00	60.64

Segment Leq : 60.64 dBA

Results segment # 2: Robert Grant (day)

Source height = 1.50 m

ROAD (0.00 + 69.64 + 0.00) = 69.64 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	73.68	0.00	-4.04	0.00	0.00	0.00	0.00	69.64

Segment Leq : 69.64 dBA

Results segment # 3: Cope Drive (day)

Source height = 1.50 m

ROAD (0.00 + 58.13 + 0.00) = 58.13 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.00	65.72	0.00	-4.57	-3.01	0.00	0.00	0.00	58.13

Segment Leq : 58.13 dBA
Total Leq All Segments: 70.42 dBA

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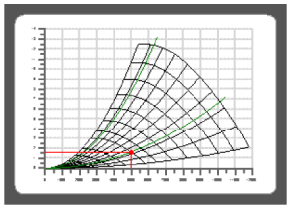
ERV-1

19/08/2019
Aeolus4 1.0.19079.1

Customer			
Project		**Description**	
Your Ref.	- -	**Our Ref.**	Tempeff

Input data					
Volume	5000 CFM	**Temperature**	68.0 °F	**Density**	0.075 lb/cu.ft
Static Pressure	1.57 In.W.G.	**Altitude**	0 ft	**Free Inlet - Free Outlet**	

	Catalogue data		
Selected Fan **ANPA18 -**	n Max 1/min	Pw Max BHP	J lb ft²
	3300		15.42



Fan Information

c ft/min	p tot * In.W.G.	p sta In.W.G.	p dyn ** In.W.G.	tip speed ft/min	RPM 1/min	eta Tot * %	eta Sta %	P fan BHP	Min Mot. BHP	P mot BHP	Shaft diameter in
	1.97	1.57	0.40	7507	1618	68.56	54.62	2.26			0.00

(*)Theoric value calculated taking into account the dynamic pressure at the impeller outlet
(**)Theoric value, calculated at the impeller outlet

fm[Hz]	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**Tot.**
Lw3 Total Sound Power Level in the inlet duct- Lwi Inlet Duct Sound Power Level includes the effect of duct end correction									
Level Lw3 dB/dB(A)	76 / 50	75 / 59	78 / 69	73 / 70	73 / 73	70 / 71	68 / 69	62 / 61	**83 / 78**
Lw5 Inlet Total Sound Power Level - Lwmi Inlet Sound Power Level (free inlet) do not includes the effect of duct end correction									
Level Lw5 dB/dB(A)	76 / 50	77 / 61	87 / 79	83 / 80	77 / 77	75 / 76	69 / 70	63 / 62	**90 / 84**
Lw6 Total Sound Power Level at the free outlet - Lwmo Outlet Sound Power Level (free outlet) do not includes the effect of duct end correction									
Level Lw6 dB/dB(A)	82 / 56	79 / 63	87 / 78	83 / 80	84 / 84	81 / 82	75 / 76	68 / 67	**91 / 88**

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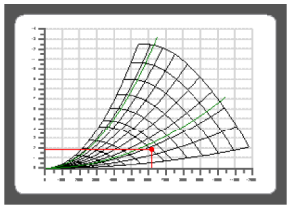
ERV-2

19/08/2019
Aeolus4 1.0.19079.1

Customer			
Project		**Description**	
Your Ref.	- -	**Our Ref.**	Tempeff

Input data					
Volume	6150 CFM	**Temperature**	68.0 °F	**Density**	0.075 lb/cu.ft
Static Pressure	1.88 In.W.G.	**Altitude**	0 ft	**Free Inlet - Free Outlet**	

	Catalogue data		
Selected Fan **ANPA18 -**	n Max 1/min	Pw Max BHP	J lb ft²
	3300		15.42



Fan Information

c ft/min	p tot * In.W.G.	p sta In.W.G.	p dyn ** In.W.G.	tip speed ft/min	RPM 1/min	eta Tot * %	eta Sta %	P fan BHP	Min Mot. BHP	P mot BHP	Shaft diameter in
	2.49	1.88	0.61	8893	1917	65.77	49.74	3.66			0.00

(*)Theoric value calculated taking into account the dynamic pressure at the impeller outlet
(**)Theoric value, calculated at the impeller outlet

fm[Hz]	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**Tot.**
Lw3 Total Sound Power Level in the inlet duct- Lwi Inlet Duct Sound Power Level includes the effect of duct end correction									
Level Lw3 dB/dB(A)	81 / 55	80 / 64	83 / 74	78 / 75	78 / 78	75 / 76	73 / 74	67 / 66	**88 / 83**
Lw5 Inlet Total Sound Power Level - Lwmi Inlet Sound Power Level (free inlet) do not includes the effect of duct end correction									
Level Lw5 dB/dB(A)	81 / 55	80 / 64	91 / 82	87 / 84	81 / 81	80 / 81	74 / 75	68 / 67	**94 / 89**
Lw6 Total Sound Power Level at the free outlet - Lwmo Outlet Sound Power Level (free outlet) do not includes the effect of duct end correction									
Level Lw6 dB/dB(A)	87 / 61	84 / 68	92 / 83	88 / 85	89 / 89	86 / 87	80 / 81	73 / 72	**96 / 93**

ERV-3

1230ERV

ENGINEERING DATA

TOTAL RECOVERY CORES
The cross-flow energy recovery cores transfer heat and water vapour between the two airstreams. They are easily removed for cleaning or service.

MOTORS
Two PSC, 3 speed double shafted, 120 VAC, 9.4 Amps each (18.8 total on high speed). HP- 1/2, 1625 RPM. MCA: 23.5 MOP: 30 Watts - total on high speed - 2256.

FILTERS
2" pleated MERV 8 filters in supply and exhaust air streams.

BLOWERS
Slide in / out easily of unit. Centrifugal type rated at 1200 CFM (566 L/s) free air delivery. Each air stream has one single shafted motor driving a centrifugal blower.

CONNECTION DUCT SIZES - Four - 20" x 8" (508 mm x 200 mm).

MOUNTING
Unit to be set on support brackets hung by threaded rod type apparatus (brackets and rods not provided).

CABINET
Unit has front and back access doors and electrical panel can be switched to either side giving installer flexibility in duct direction.
20 gauge prepainted galvanized steel (G60) for superior corrosion resistance.
Insulated with foil faced insulation where required to prevent exterior condensation.

ELECTRONICS
Integrated microprocessor circuit board. Built-in interlock contacts. Optional remote speed control.

FROST PREVENTION
Temperature sensor activated, periodically shuts down supply motor. Drains not required.

WEIGHT 285 LBS (130 KG) **SHIPPING WEIGHT** 335 LBS. (152 KG)

CONTROL OPTION

99-BC04 Lifebreath Ventilation Control

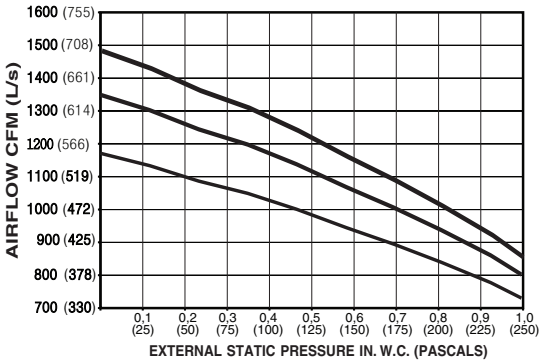
- 2 speed fan setting (Low/High)
- 2 modes of operation: Ventilation, 20/40
- Compatible with 99-DET02 Wireless Timers
- 3 wire connection; 20 gauge wire (minimum)

WARRANTY

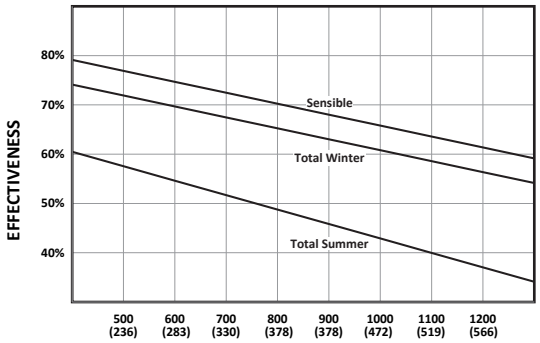
Units carry a 10 year warranty on the ERV core and a 2 year replacement parts warranty.

PERFORMANCE

AIRFLOWS (Each Air Stream)



TOTAL EFFECTIVENESS



AHRI CERTIFIED® www.ahridirectory.org
Globally Recognized. Industry Respected.

AHRI 1060 Certified Core:
Contains three 68-280

TIMER OPTIONS

99-DET01 Lifebreath 20/40/60 Minute Timer

- Initiates high speed Ventilation for 20, 40 or 60 minutes
- 3 wire connection; 20 gauge wire (minimum)

99-DET02 Lifebreath WIRELESS 20/40/60 Minute Timer

- Initiates high speed Ventilation for 20, 40 or 60 minutes
- Wirelessly connects to main control for ease of installation
- 40' approximate range

99-RX02 Lifebreath WIRELESS Repeater

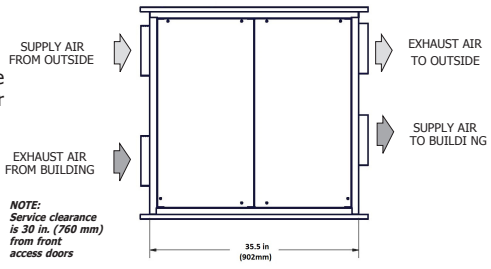
- Used to extend range of 99-DET02 Wireless Timers when Timers are out of range
- Plugs into 120V power outlet and wirelessly connects to main control and 99-DET02

DIMENSIONS inches (mm)

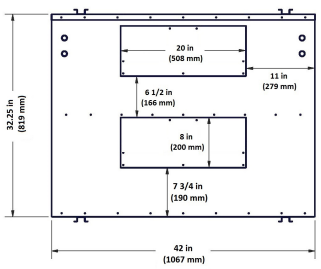
NOTE: The 1230ERV model may easily be reversed in the field. Refer to page 22 for installation instructions .

All units conform to CS A and UL standards

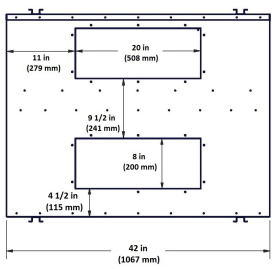
NOTE: All specifications are subject to change without notice.



FRONT VIEW



DISCHARGE SIDE



INLET SIDE

Date: _____

Tag:_____Qty:_____

Project:_____

Engineer: _____

Contractor:_____

Supplier:_____

Quote#:_____

Submitted by: _____

ERV-3

Cuhaci 700 Cope Copy of EXCEL Fan Sound Power Level Prediction per ASHRAE 2019-11-29

ASHRAE Fan Sound Power Level Calculation per Reynolds's Algorithms for HVAC Acoustics p.3-1
Note: Use manufacturer data where possible/ This method is no longer in ASHRAE Handbooks

Airflow	1200	CFM
Brake Horsepower	0.5	BHP
Static Press	1.35	in. w.g.
Peak Efficiency (Manuf.)	85	%
Operating Efficiency	51	%
Static Efficiency	60	%
Correction Factor	0	dB
Fan Power level Addition	33.4	

Fan operating condition

Static Pressure (in. w.g.)	
Plenum	0.16
Cooling Coil	0.38
Heating Coil	0.11
Grill	0.05
Filter	0.15
Internal SP	0.85
External SP	0.5
Total Static Pressur	1.35

Freq.	63	125	250	500	1000	2000	4000	8000	dBA	
Forward Curved, All sizes	53	53	43	36	36	31	26	21	42.1	SWL
	33.4	33.4	33.4	33.4	33.4	33.4	33.4	33.4	40.4	SWL
Predicted Lw	**86**	**86**	**76**	**69**	**69**	**64**	**59**	**54**	75.5	SWL

Specific Fan Sound Power Levels (Table 3.1) for fan at 1 cfm and 1" w.g.

	63	125	250	500	1000	2000	4000	8000
Centrifugal Backward Curved Backward Inclined, <36"	40	40	39	34	30	23	19	17
Centrifugal Backward Curved Backward Inclined, >36"	45	45	43	39	34	28	24	19
Forward Curved, All sizes	53	53	43	36	36	31	26	21
Radial, Material Wheel, 4-10 in. w.g.	56	47	43	39	37	32	29	26
Radial, Medium Wheel, 6-15 in. w.g.	58	54	45	42	38	33	29	26
Radial, High Pressure,15-60 in. w.g.	61	58	53	48	46	44	41	38
Vaneaxial, Hub Ratio 0.3-0.4	49	43	43	48	47	45	38	34
Vaneaxial, Hub Ratio 0.4-0.6	49	43	46	43	41	36	30	28
Vaneaxial, Hub Ratio 0.6-0.8	53	52	51	51	49	47	43	40
Tubeaxial >40"	51	46	47	49	47	46	39	37
Tubeaxial <40"	48	47	49	53	52	51	43	40
Propeller, All	48	51	58	56	55	52	46	42

Use for comparison of two fan power levels

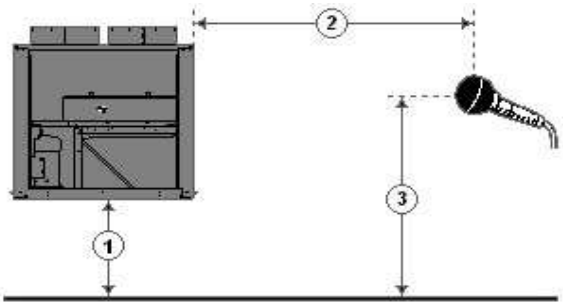
	63	125	250	500	1000	2000	4000	8000	dBA	
ESP 270 cfm	61	61	51	44	44	39	34	29	49.9	SWL
ESP 348 cfm	62	62	52	45	45	40	35	30	51.0	SWL
Diff	**-1**	**-1**	**-1**	**-1**	**-1**	**-1**	**-1**	**-1**	-1.1	

Detailed Performance Summary For 30RB 100GS 12 Deg 35PP

Project: OCDSB Cope Dr Stittsville GWAL 10 29 19 | CH-1,2 | 10/29/2019
Prepared By: | | 02:30PM

Unit Parameters

Tag Name:	**30RB 100GS 12 Deg 35PP**	
Model Number:	**30RB100**	
Condenser Type:	**Air Cooled**	
Compressor Type:	**Scroll**	
Chiller Nameplate Voltage:	**575-3-60**	V-Ph-Hz
Quantity:	**1**	
Manufacturing Source:	**Charlotte, NC USA**	
Refrigerant:	**R-410A**	
Shipping Weight:	**5398**	lb
Operating Weight:	**5663**	lb
Refrigerant Weight (Circuit A):	**40**	lb
Refrigerant Weight (Circuit B):	**40**	lb
Unit Length:	**142**	in
Unit Width:	**89**	in
Unit Height:	**90**	in



1 - Chiller Height Above Ground
2 - Horizontal Distance From Chiller to Receiver
3 - Receiver Height Above Ground
(See Note 3)

Accessories and Installed Options

- Freeze Protection
- Suction Service Valves
- Non-Fused Disconnect
- Micro Channel
- Ultra Low Sound Option
- CRN Cooler (Canada)
- Minimum Load Control
- Single Point
- LON Translator Control
- No Coil Trim Panels
- Greenspeed Intelligence: High-Efficiency Variable Condenser Fans

Acoustic Information

Table 1. A-Weighted Sound Power Levels (dB re 1 picowatt). See note #1.

Octave Band Center Frequency, Hz	31	63	125	250	500	1k	2k	4k	8k	Overall
100% Load	---	67	79	86	91	96	90	87	79	99
75% Load	---	66	80	86	90	94	90	86	78	98
50% Load	---	60	66	75	80	81	79	77	74	86
25% Load	---	58	64	72	77	79	77	75	71	84

Table 2. A-Weighted Sound Pressure Levels (dB re 20 micropascals) calculated based upon user defined input for dimensions 1, 2 and 3 as shown in above diagram. See note #2 and #3.

Octave Band Center Frequency, Hz	31	63	125	250	500	1k	2k	4k	8k	Overall
100% Load	---	38	51	58	63	68	62	59	51	70
75% Load	---	38	52	58	62	66	62	58	50	69
50% Load	---	32	38	47	52	53	51	49	46	58
25% Load	---	30	36	44	49	51	48	47	43	55

Notes: (1) Measurements performed in accordance with AHRI Standard 370-2015 for air cooled Chillers.
(2) Chiller is assumed to be a point source on a reflecting plane.
(3) Without user defined input, the default dimensions used to construct Table 2 are as follows:
1 - Chiller Height Above Ground = 0.0 ft
2 - Horizontal Distance From Chiller to Receiver = 30.0 ft
3 - Receiver Height Above Ground = 3.0 ft

Technical Data Sheet for Gym

RTU-1,2

Condensing Section

Compressor

Type	Quantity	Refrigerant Charge lb	Total Power	Capacity Control	Compressor Isolation
Inverter Scroll	1	30.7	12.65 kW	Mod Control with Inverter Compressors	Rubber in Shear

Compressor Amps:

Compressor 1	20.5 A

Compressor Options: Suction and Discharge Isolation Valves

Condenser Coil

Type	Fins per Inch	Fin Material
Aluminum Microchannel	23	Aluminum

Condenser Fan Motors

Number of Motors	Full Load Current (Total)
1	2.8 A

AHRI 360 Certified Data at AHRI 360 Standard Conditions

Net Capacity	EER	IEER	ASHRAE 90.1
190000 Btu/hr	11.4	20.2	ASHRAE 90.1-2016 compliant

Internal Pressure Drop Calculation

External Static Pressure:	1.00 inH_2O
Filter:	0.11 inH_2O
Outside Air:	0.25 inH_2O
Energy Recovery:	1.22 inH_2O
DX Coil:	0.42 inH_2O
Hot Gas Reheat:	0.06 inH_2O
Hot Water Heat:	0.70 inH_2O
Total Static Pressure:	3.78 inH_2O

Sound

Sound Power (db)

Frequency	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Inlet	83	82	87	85	77	76	71	68
Discharge	89	88	90	91	86	83	78	73
Radiated	80	74	76	76	75	72	73	65

Options

Electrical

Field Connection:	Non-Fused Disconnect Switch
Powered Receptacle:	Field powered 115V GFI outlet
Power Options:	Phase Failure Monitor

Warranty

Parts:	Standard One Year
Compressor:	Standard One Year

AHRI Certification

All equipment is rated and certified in accordance with AHRI 360.

Technical Data Sheet for Cafe

RTU-4

	Sound							
	Sound Power (db)							
Frequency	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Inlet	76	80	76	79	75	72	68	63
Discharge	76	80	76	79	75	72	68	63
Radiated	85	85	81	78	76	71	64	57

Options

Electrical	
Field Connection:	Non-Fused Disconnect Switch
Powered Receptacle:	Field powered 115V GFI outlet
Power Options:	Phase Failure Monitor

Warranty

Parts:	Standard One Year
Compressor:	Standard One Year

AHRI Certification

All equipment is rated and certified in accordance with AHRI 360.

Specials

Unit	
Specials Description:	Custom Heating Coil for 85F LAT and 150-120F, 35% PG

Notes

Accessories

Mandatory	
Part Number	Description
910190890	HUMIDITY SENSOR, DUCT MOUNTED, 0-5VDC

Optional	
Part Number	Description
072502001	Freezestat
910119532	24" Roof Curb, No ERW, Size 007 - 015

Technical Data Sheet for Science Lab

RTU-3

	Sound							
	Sound Power (db)							
Frequency	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Inlet	70	72	74	69	64	63	58	55
Discharge	76	78	77	75	73	70	65	60
Radiated	80	74	76	76	75	72	73	65

Options

Electrical	
Field Connection:	Non-Fused Disconnect Switch
Powered Receptacle:	Field powered 115V GFI outlet
Power Options:	Phase Failure Monitor

Warranty

Parts:	Standard One Year
Compressor:	Standard One Year

AHRI Certification

All equipment is rated and certified in accordance with AHRI 360.

Notes

Accessories

Mandatory	
Part Number	Description
910190890	HUMIDITY SENSOR, DUCT MOUNTED, 0-5VDC

Optional	
Part Number	Description
072502001	Freezestat
910168727	24" Roof Curb, No ERW, Size 016-028

Technical Data Sheet for AHU-1

AHU-1

Supply Fan	Component: 8	Length: 48 in	Shipping Section: 7

Fan Performance

Air Volume	Static Pressure			Brake Horsepower	Speed		Outlet Velocity
	External	Total	Cabinet		Operating	Maximum	
8000 cfm	1.50 inWc	5.24 inWc	0.06 inWc	10.06 BHP	2055 rpm	2403 rpm	0 ft/min

Fan Data

Fan Type	Blade Type / Class	Quantity of Fans	Wheel Diameter	Material Type	Number of Blades	Discharge	Motor Location
Centrifugal - Plenum	Airfoil / 2	1	22.25 in	Aluminum	9	-	Behind Fan

Motor Data

Power	Electrical Supply	Speed	Efficiency	Enclosure	Frame Size	Supplier	Number of Poles	Lock Rotor Current	Full Load Current
15.0 HP	575/60/3 V/Hz/Phase	1750 rpm	Premium	ODP	254 T frame	Generic	4	92.80 A	14.30 A

Fan Options

Wheel Guard:	Provided	Seismic Restraint:	With snubbers
Inlet Screen:	Provided	Shaft Grounding Kit:	Provided
Isolator Type:	Spring		

VFD/Starter/Disconnect Data

Selection Type:	External J-Box	Vendor:	Factory Standard
Voltage:	575 V	Height x Width x Depth:	6.00 in x 6.00 in x 4.00 in
Mounting:	Door Side	Enclosure:	NEMA 1

Custom Openings

Custom Opening	Location	Width	Height	Rainhood w/Screen
1	Top	60 in	20 in	None

Door

Location	Width	Opening
Drive side	30 in	Outward

Unit Sound Power (dB)

Type	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
Radiated:	74	74	79	66	64	55	46	51
Unit Discharge:	84	79	90	85	86	83	78	72
Unit Return:	74	74	80	74	68	66	60	53

Technical Data Sheet for AHU-2

AHU-2

Supply Fan	Component: 8	Length: 46 in	Shipping Section: 7

Fan Performance

Air Volume	Static Pressure			Brake Horsepower	Speed		Outlet Velocity
	External	Total	Cabinet		Operating	Maximum	
7200 cfm	1.50 inWc	5.35 inWc	0.07 inWc	9.42 BHP	2406 rpm	2674 rpm	0 ft/min

Fan Data

Fan Type	Blade Type / Class	Quantity of Fans	Wheel Diameter	Material Type	Number of Blades	Discharge	Motor Location
Centrifugal - Plenum	Airfoil / 2	1	20.00 in	Aluminum	9	-	Behind Fan

Motor Data

Power	Electrical Supply	Speed	Efficiency	Enclosure	Frame Size	Supplier	Number of Poles	Lock Rotor Current	Full Load Current
15.0 HP	575/60/3 V/Hz/Phase	1750 rpm	Premium	ODP	254 T frame	Generic	4	92.80 A	14.30 A

Fan Options

Wheel Guard:	Provided	Seismic Restraint:	With snubbers
Inlet Screen:	Provided	Shaft Grounding Kit:	Provided
Isolator Type:	Spring		

VFD/Starter/Disconnect Data

Selection Type:	External J-Box	Vendor:	Factory Standard
Voltage:	575 V	Height x Width x Depth:	6.00 in x 6.00 in x 4.00 in
Mounting:	Door Side	Enclosure:	NEMA 1

Custom Openings

Custom Opening	Location	Width	Height	Rainhood w/Screen
1	End	60 in	16 in	None

Door

Location	Width	Opening
Drive side	30 in	Outward

Unit Sound Power (dB)

Type	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
Radiated:	75	73	74	73	66	57	46	51
Unit Discharge:	85	80	84	91	88	84	81	75
Unit Return:	75	75	82	76	70	68	62	54

Technical Data Sheet for AHU-3

AHU-3

Supply Fan	Component: 8	Length: 48 in	Shipping Section: 7

Fan Performance

Air Volume	Static Pressure			Brake Horsepower	Speed		Outlet Velocity
	External	Total	Cabinet		Operating	Maximum	
9250 cfm	1.50 inWc	5.10 inWc	0.08 inWc	11.64 BHP	2173 rpm	2403 rpm	0 ft/min

Fan Data

Fan Type	Blade Type / Class	Quantity of Fans	Wheel Diameter	Material Type	Number of Blades	Discharge	Motor Location
Centrifugal - Plenum	Airfoil / 2	1	22.25 in	Aluminum	9	-	Behind Fan

Motor Data

Power	Electrical Supply	Speed	Efficiency	Enclosure	Frame Size	Supplier	Number of Poles	Lock Rotor Current	Full Load Current
15.0 HP	575/60/3 V/Hz/Phase	1750 rpm	Premium	ODP	254 T frame	Generic	4	92.80 A	14.30 A

Fan Options

Wheel Guard:	Provided	Seismic Restraint:	With snubbers
Inlet Screen:	Provided	Shaft Grounding Kit:	Provided
Isolator Type:	Spring		

VFD/Starter/Disconnect Data

Selection Type:	External J-Box	Vendor:	Factory Standard
Voltage:	575 V	Height x Width x Depth:	6.00 in x 6.00 in x 4.00 in
Mounting:	Door Side	Enclosure:	NEMA 1

Custom Openings

Custom Opening	Location	Width	Height	Rainhood w/Screen
1	Top	60 in	20 in	None

Door

Location	Width	Opening
Drive side	30 in	Outward

Unit Sound Power (dB)

Type	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
Radiated:	77	74	80	67	66	58	46	51
Unit Discharge:	86	80	90	86	88	85	82	75
Unit Return:	77	74	83	75	71	70	66	58

Technical Data Sheet for AHU-4

AHU-4

Supply Fan	Component: 8	Length: 48 in	Shipping Section: 7

Fan Performance

Air Volume	Static Pressure			Brake Horsepower	Speed		Outlet Velocity
	External	Total	Cabinet		Operating	Maximum	
8000 cfm	1.50 inWc	5.29 inWc	0.06 inWc	10.14 BHP	2060 rpm	2403 rpm	0 ft/min

Fan Data

Fan Type	Blade Type / Class	Quantity of Fans	Wheel Diameter	Material Type	Number of Blades	Discharge	Motor Location
Centrifugal - Plenum	Airfoil / 2	1	22.25 in	Aluminum	9	-	Behind Fan

Motor Data

Power	Electrical Supply	Speed	Efficiency	Enclosure	Frame Size	Supplier	Number of Poles	Lock Rotor Current	Full Load Current
15.0 HP	575/60/3 V/Hz/Phase	1750 rpm	Premium	ODP	254 T frame	Generic	4	92.80 A	14.30 A

Fan Options

Wheel Guard:	Provided	Seismic Restraint:	With snubbers
Inlet Screen:	Provided	Shaft Grounding Kit:	Provided
Isolator Type:	Spring		

VFD/Starter/Disconnect Data

Selection Type:	External J-Box	Vendor:	Factory Standard
Voltage:	575 V	Height x Width x Depth:	6.00 in x 6.00 in x 4.00 in
Mounting:	Door Side	Enclosure:	NEMA 1

Custom Openings

Custom Opening	Location	Width	Height	Rainhood w/Screen
1	Top	60 in	20 in	None

Door

Location	Width	Opening
Drive side	30 in	Outward

Unit Sound Power (dB)

Type	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
Radiated:	75	75	79	66	65	57	46	51
Unit Discharge:	84	79	90	85	86	83	78	72
Unit Return:	75	75	83	76	71	70	65	57

Technical Data Sheet for AHU-5

AHU-5

Supply Fan	Component: 8	Length: 48 in	Shipping Section: 7

Fan Performance

Air Volume	Static Pressure			Brake Horsepower	Speed		Outlet Velocity
	External	Total	Cabinet		Operating	Maximum	
8500 cfm	1.50 inWc	5.47 inWc	0.06 inWc	11.20 BHP	2132 rpm	2403 rpm	0 ft/min

Fan Data

Fan Type	Blade Type / Class	Quantity of Fans	Wheel Diameter	Material Type	Number of Blades	Discharge	Motor Location
Centrifugal - Plenum	Airfoil / 2	1	22.25 in	Aluminum	9	-	Behind Fan

Motor Data

Power	Electrical Supply	Speed	Efficiency	Enclosure	Frame Size	Supplier	Number of Poles	Lock Rotor Current	Full Load Current
15.0 HP	575/60/3 V/Hz/Phase	1750 rpm	Premium	ODP	254 T frame	Generic	4	92.80 A	14.30 A

Fan Options

Wheel Guard:	Provided	Seismic Restraint:	With snubbers
Inlet Screen:	Provided	Shaft Grounding Kit:	Provided
Isolator Type:	Spring		

VFD/Starter/Disconnect Data

Selection Type:	External J-Box	Vendor:	Factory Standard
Voltage:	575 V	Height x Width x Depth:	6.00 in x 6.00 in x 4.00 in
Mounting:	Door Side	Enclosure:	NEMA 1

Custom Openings

Custom Opening	Location	Width	Height	Rainhood w/Screen
1	Top	60 in	20 in	None

Door

Location	Width	Opening
Drive side	30 in	Outward

Unit Sound Power (dB)

Type	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
Radiated:	76	76	80	67	65	58	46	51
Unit Discharge:	86	80	90	86	87	85	81	74
Unit Return:	76	77	83	77	71	69	63	55

Technical Data Sheet for AHU-6

AHU-6

Supply Fan	Component: 8	Length: 46 in	Shipping Section: 7

Fan Performance

Air Volume	Static Pressure			Brake Horsepower	Speed		Outlet Velocity
	External	Total	Cabinet		Operating	Maximum	
6500 cfm	1.50 inWc	5.11 inWc	0.06 inWc	8.01 BHP	2273 rpm	2674 rpm	0 ft/min

Fan Data

Fan Type	Blade Type / Class	Quantity of Fans	Wheel Diameter	Material Type	Number of Blades	Discharge	Motor Location
Centrifugal - Plenum	Airfoil / 2	1	20.00 in	Aluminum	9	-	Behind Fan

Motor Data

Power	Electrical Supply	Speed	Efficiency	Enclosure	Frame Size	Supplier	Number of Poles	Lock Rotor Current	Full Load Current
10.0 HP	575/60/3 V/Hz/Phase	1750 rpm	Premium	ODP	215 T frame	Generic	4	64.80 A	10.00 A

Fan Options

Wheel Guard:	Provided	Seismic Restraint:	With snubbers
Inlet Screen:	Provided	Shaft Grounding Kit:	Provided
Isolator Type:	Spring		

VFD/Starter/Disconnect Data

Selection Type:	External J-Box	Vendor:	Factory Standard
Voltage:	575 V	Height x Width x Depth:	6.00 in x 6.00 in x 4.00 in
Mounting:	Door Side	Enclosure:	NEMA 1

Custom Openings

Custom Opening	Location	Width	Height	Rainhood w/Screen
1	Top	48 in	20 in	None

Door

Location	Width	Opening
Drive side	30 in	Outward

Unit Sound Power (dB)

Type	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
Radiated:	74	72	78	65	63	54	46	51
Unit Discharge:	84	79	88	84	85	82	78	72
Unit Return:	74	73	80	73	67	65	59	53

Technical Data Sheet for AHU-7

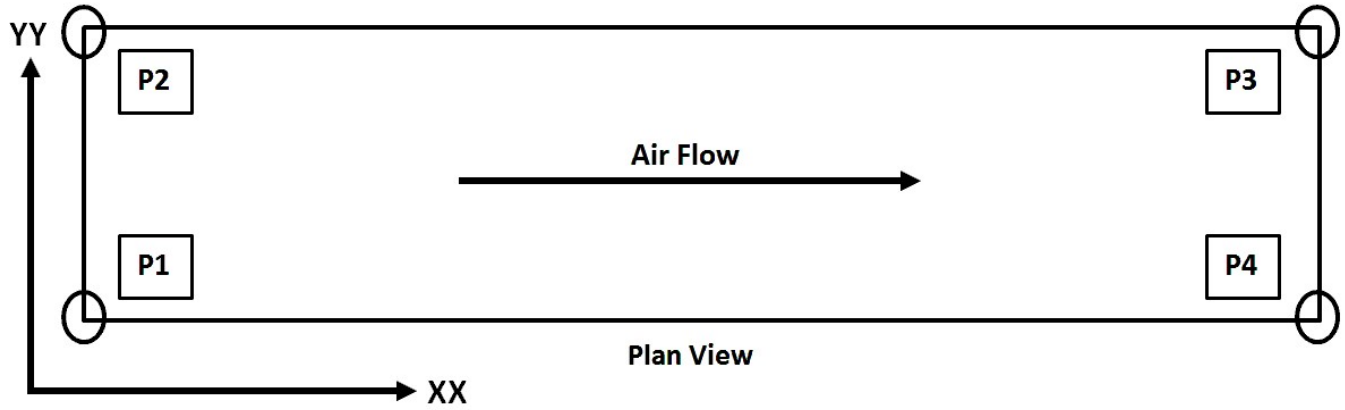
AHU-7

Unit Sound Power (dB)

Type	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
Radiated:	70	67	64	71	62	56	46	51
Unit Discharge:	80	77	79	88	84	84	82	75
Unit Return:	70	67	71	71	62	63	59	51

Shipping Section Details

Section	Length in	Weight lb	Corner Weights (lb)				Center of Gravity (in)		
			P1	P2	P3	P4	XX	YY	ZZ
1	96	802	192	196	209	205	50	26	22
2	144	1808	427	450	477	454	74	27	23
Entire Unit	**144** *Lower level only*	**2610**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**



NOTE: Special components aren't included in the corner weights and center of gravity data.

AHRI Certification

Supply fan performance is certified in accordance with the Central Station Air-Handling Unit Certification Program, which is based on AHRI Standard 430.

Notes

Standard

1. As a standalone component, unit meets or exceeds requirements of ASHRAE 90.1 - 2013. The approving authority is responsible for compliance of multi - component building systems.

EF-1-4

Job Name: CUE-099-VG Cut Sheet
Tag: MK-1
Quantity: 1
Printed Date: November 13, 2019

Model: CUE-099-VG

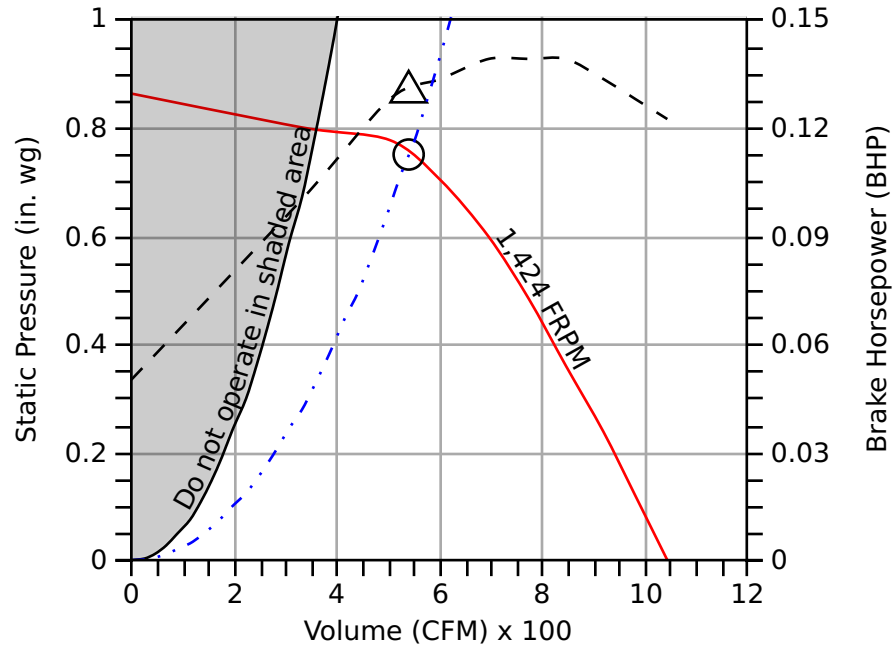
Direct Drive Upblast Centrifugal Roof Exhaust Fan

Standard Construction Features: Aluminum housing. Centrifugal backward inclined aluminum wheel. Direct driven motor mounted on vibration isolation.

Fan Configuration	
Drive type	Direct

Performance	
Requested Volume (CFM)	538
Actual Volume (CFM)	538
Total External SP (in. wg)	0.75
Fan RPM	1,424
Operating Power (bhp)	0.13
Startup Power (bhp)	0.13
Air Stream Temp (F)	70
Start-up Temp (F)	70
Air Density (lbs/ft^3)	0.074
Elevation (ft)	333
Static Efficiency (%)	49
Outlet Velocity (ft/min)	420

Motor	
Enclosure	ODP
Size (hp)	1/4
V/C/P	115/60/1
NEC FLA (Amps)	3.7



Fan curve
Brake horsepower curve
Operating Point SP
Operating Bhp point
Max system curve
System curve

Sound

	Octave Bands (hz)								LwA	dBA	Sones
	62.5	125	250	500	1000	2000	4000	8000			
Inlet	73	71	68	62	59	59	55	46	66	55	7.5

Greenheck Fan Corporation certifies that the model shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and AMCA Publication 311 and comply with the requirements of the AMCA Certified Ratings Program.Performance certified is for installation type A: Free inlet, Free outlet.Power rating (BHP/kW) does not include transmission losses.Performance ratings do not include the effects of appurtenances (accessories).The sound ratings shown are loudness values in fan sones at 5 ft. (1.5 m) in a hemispherical free field calculated per AMCA Standard 301. Values shown are for installation type A: free inlet hemispherical sone levels. dBA levels are not licensed by AMCA International. The AMCA Certified Ratings Seal for Sound applies to inlet sone ratings only.

FLA - based on tables 150 or 148 of National Electric Code 2002. Actual motor FLA may vary, for sizing thermal overload, consult factory.

EF-5-8

Job Name: CUE-121-VG Cut Sheet
Tag: MK-1
Quantity: 1
Printed Date: November 13, 2019

Model: CUE-121-VG

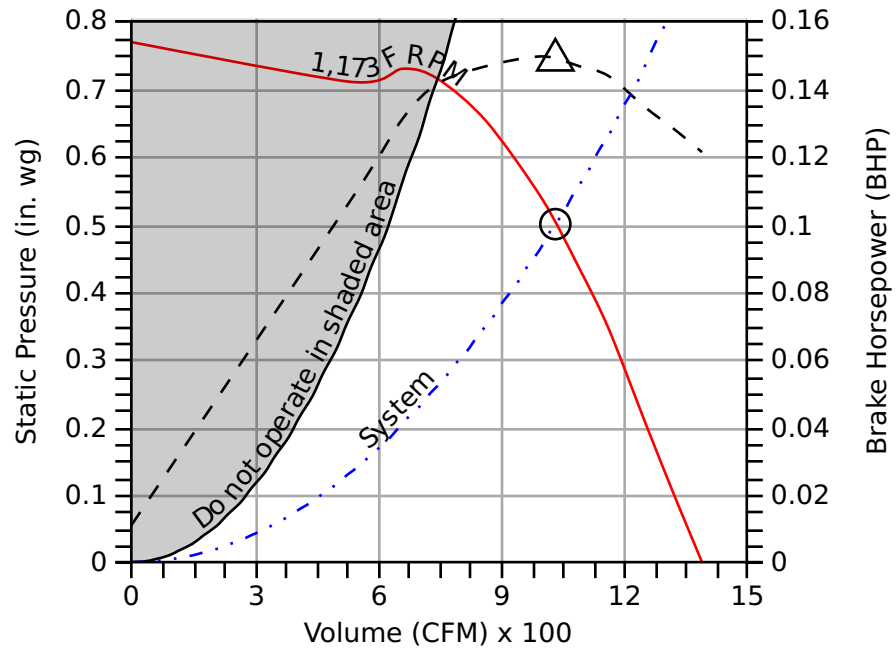
Direct Drive Upblast Centrifugal Roof Exhaust Fan

Standard Construction Features: Aluminum housing. Centrifugal backward inclined aluminum wheel. Direct driven motor mounted on vibration isolation.

Fan Configuration	
Drive type	Direct

Performance	
Requested Volume (CFM)	1,030
Actual Volume (CFM)	1,030
Total External SP (in. wg)	0.5
Fan RPM	1,173
Operating Power (bhp)	0.15
Startup Power (bhp)	0.15
Air Stream Temp (F)	70
Start-up Temp (F)	70
Air Density (lbs/ft^3)	0.074
Elevation (ft)	333
Static Efficiency (%)	55
Outlet Velocity (ft/min)	805

Motor	
Enclosure	ODP
Size (hp)	1/4
V/C/P	115/60/1
NEC FLA (Amps)	3.7



- Fan curve
- Brake horsepower curve
- Operating Point SP
- Operating Bhp point
- Max system curve
- System curve

Sound

	Octave Bands (hz)								LwA	dBA	Sones
	62.5	125	250	500	1000	2000	4000	8000			
Inlet	71	73	74	63	59	61	51	43	69	57	8.6

Greenheck Fan Corporation certifies that the model shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and AMCA Publication 311 and comply with the requirements of the AMCA Certified Ratings Program.Performance certified is for installation type A: Free inlet, Free outlet.Power rating (BHP/kW) does not include transmission losses.Performance ratings do not include the effects of appurtenances (accessories).The sound ratings shown are loudness values in fan sones at 5 ft. (1.5 m) in a hemispherical free field calculated per AMCA Standard 301. Values shown are for installation type A: free inlet hemispherical sone levels. dBA levels are not licensed by AMCA International. The AMCA Certified Ratings Seal for Sound applies to inlet sone ratings only.

FLA - based on tables 150 or 148 of National Electric Code 2002. Actual motor FLA may vary, for sizing thermal overload, consult factory.

EF-9

Job Name: CUE-090-VG Cut Sheet
Tag: MK-1
Quantity: 1
Printed Date: November 13, 2019

Model: CUE-090-VG

Direct Drive Upblast Centrifugal Roof Exhaust Fan

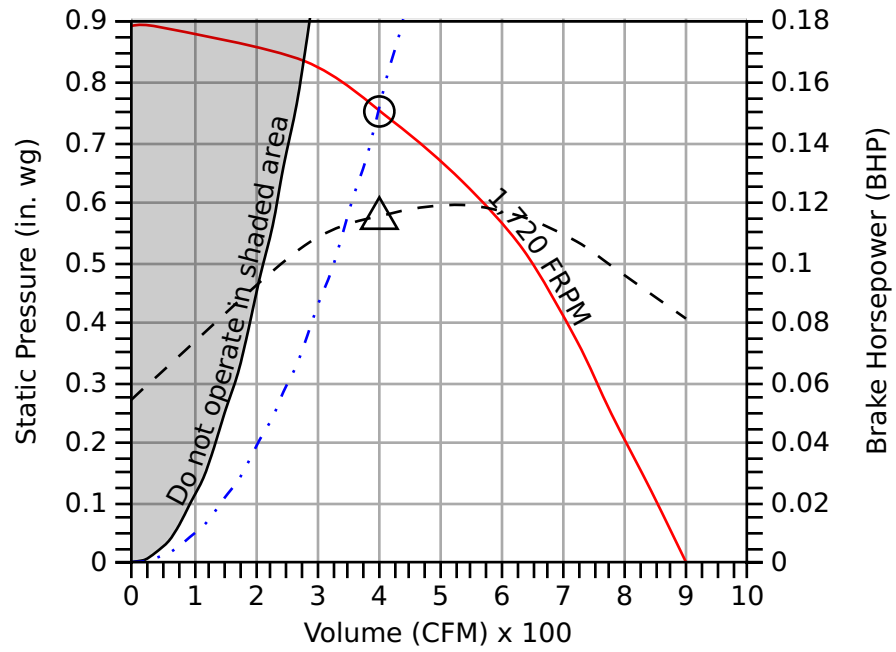
Standard Construction Features: Aluminum housing. Centrifugal backward inclined aluminum wheel. Direct driven motor mounted on vibration isolation.

Fan Configuration	
Drive type	Direct

Performance	
Requested Volume (CFM)	400
Actual Volume (CFM)	400
Total External SP (in. wg)	0.75
Fan RPM	1,720
Operating Power (bhp)	0.11
Startup Power (bhp)	0.11
Air Stream Temp (F)	70
Start-up Temp (F)	70
Air Density (lbs/ft^3)	0.074
Elevation (ft)	333
Static Efficiency (%)	41
Outlet Velocity (ft/min)	571

Motor	
Enclosure	TENV
Size (hp)	1/6
V/C/P	115/60/1
NEC FLA (Amps)	3.4

FLA - based on tables 150 or 148 of National Electric Code 2002. Actual motor FLA may vary, for sizing thermal overload, consult factory.



Fan curve
Brake horsepower curve
Operating Point SP
Operating Bhp point
Max system curve
System curve

Sound

	Octave Bands (hz)								LwA	dBA	Sones
	62.5	125	250	500	1000	2000	4000	8000			
Inlet	79	76	71	65	61	57	53	47	69	57	9.0

Greenheck Fan Corporation certifies that the model shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and AMCA Publication 311 and comply with the requirements of the AMCA Certified Ratings Program.Performance certified is for installation type A: Free inlet, Free outlet.Power rating (BHP/kW) does not include transmission losses.Performance ratings do not include the effects of appurtenances (accessories).The sound ratings shown are loudness values in fan sones at 5 ft. (1.5 m) in a hemispherical free field calculated per AMCA Standard 301. Values shown are for installation type A: free inlet hemispherical sone levels. dBA levels are not licensed by AMCA International. The AMCA Certified Ratings Seal for Sound applies to inlet sone ratings only.

EF-10

Job Name: CUE-121-VG Cut Sheet
Tag: MK-1
Quantity: 1
Printed Date: November 13, 2019

Model: CUE-121-VG

Direct Drive Upblast Centrifugal Roof Exhaust Fan

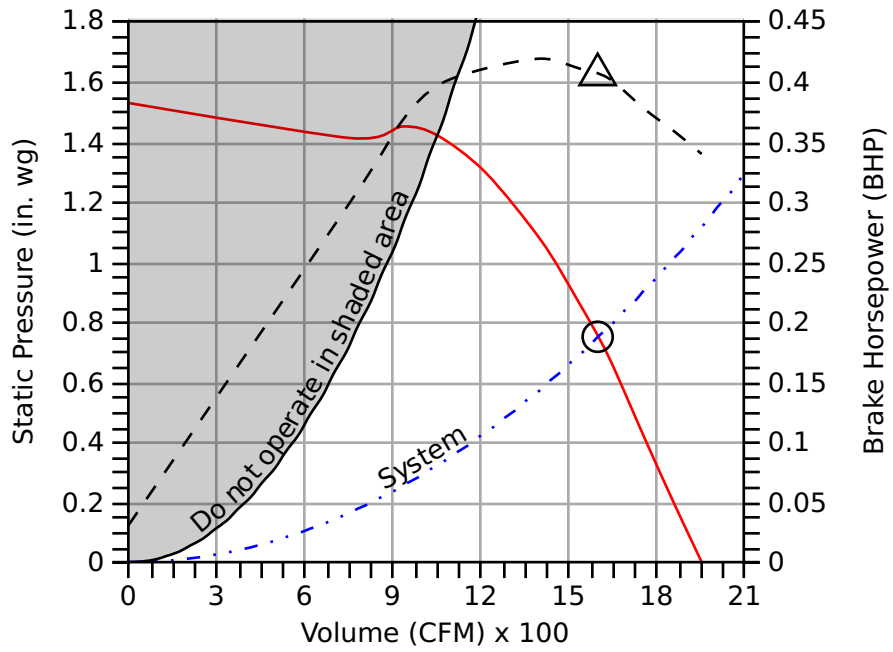
Standard Construction Features: Aluminum housing. Centrifugal backward inclined aluminum wheel. Direct driven motor mounted on vibration isolation.

Fan Configuration	
Drive type	Direct

Performance	
Requested Volume (CFM)	1,600
Actual Volume (CFM)	1,600
Total External SP (in. wg)	0.75
Fan RPM	1,654
Operating Power (bhp)	0.41
Startup Power (bhp)	0.41
Air Stream Temp (F)	70
Start-up Temp (F)	70
Air Density (lbs/ft^3)	0.074
Elevation (ft)	333
Static Efficiency (%)	47
Outlet Velocity (ft/min)	1,250

Motor	
Enclosure	ODP
Size (hp)	1/2
V/C/P	115/60/1
NEC FLA (Amps)	6.2

FLA - based on tables 150 or 148 of National Electric Code 2002. Actual motor FLA may vary, for sizing thermal overload, consult factory.



Fan curve
Brake horsepower curve
Operating Point SP
Operating Bhp point
Max system curve
System curve

Sound

	Octave Bands (hz)								LwA	dBA	Sones
	62.5	125	250	500	1000	2000	4000	8000			
Inlet	80	80	88	72	68	67	62	54	81	69	17.0

Greenheck Fan Corporation certifies that the model shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and AMCA Publication 311 and comply with the requirements of the AMCA Certified Ratings Program.Performance certified is for installation type A: Free inlet, Free outlet.Power rating (BHP/kW) does not include transmission losses.Performance ratings do not include the effects of appurtenances (accessories).The sound ratings shown are loudness values in fan sones at 5 ft. (1.5 m) in a hemispherical free field calculated per AMCA Standard 301. Values shown are for installation type A: free inlet hemispherical sone levels. dBA levels are not licensed by AMCA International. The AMCA Certified Ratings Seal for Sound applies to inlet sone ratings only.

KEF-1

Job Name: CUE-141-VG Cut Sheet
Tag: MK-1
Quantity: 1
Printed Date: November 19, 2019

Model: CUE-141-VG

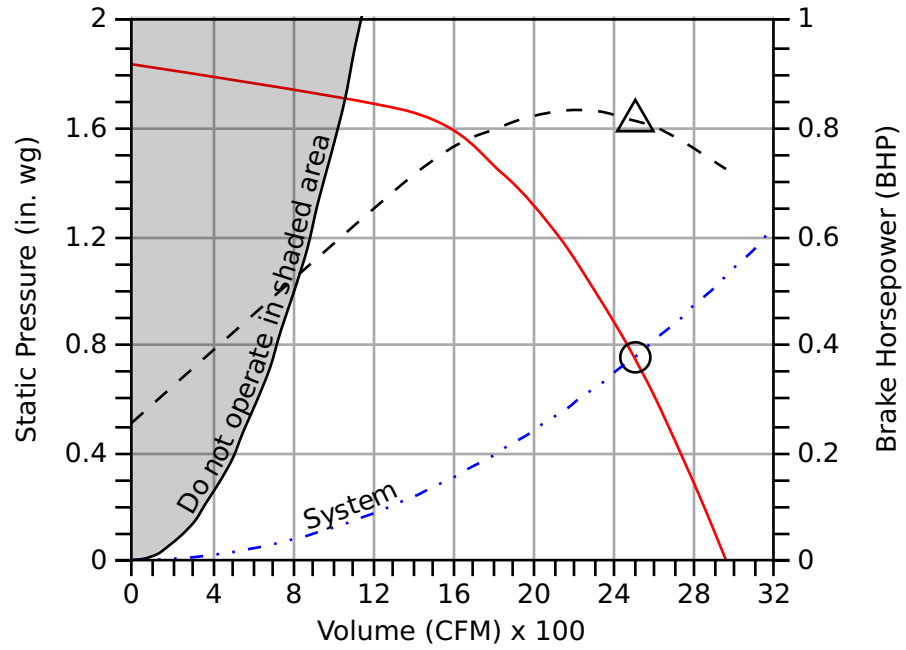
Direct Drive Upblast Centrifugal Roof Exhaust Fan

Standard Construction Features: Aluminum housing. Centrifugal backward inclined aluminum wheel. Direct driven motor mounted on vibration isolation.
Certifications/special requirements: Restaurant Exhaust

Fan Configuration	
Drive type	Direct

Performance	
Requested Volume (CFM)	2,500
Actual Volume (CFM)	2,500
Total External SP (in. wg)	0.75
Fan RPM	1,630
Operating Power (bhp)	0.81
Startup Power (bhp)	0.81
Air Stream Temp (F)	70
Start-up Temp (F)	70
Air Density (lbs/ft^3)	0.074
Elevation (ft)	333
Static Efficiency (%)	36
Outlet Velocity (ft/min)	1,453

Motor	
Enclosure	ODP
Size (hp)	1
V/C/P	208/60/3
NEC FLA (Amps)	4.6



Fan curve
Brake horsepower curve
Operating Point SP
Operating Bhp point
Max system curve
System curve

Sound

	Octave Bands (hz)								LwA	dBA	Sones
	62.5	125	250	500	1000	2000	4000	8000			
Inlet	70	69	83	77	69	54	61	60	78	66	13.7

Performance certified is for installation type A: Free inlet, free outlet.Power rating does not include transmission losses.Performance ratings do not include the effects of appurtenances.The sound ratings shown are loudness values in hemispherical sones at 1.5 m (5 ft) in a hemispherical free field calculated per ANSI/AMCA Standard 301.Values shown are for Installation Type A: free inlet hemispherical sone levels.dBA levels are not licensed by AMCA International. The AMCA Certified Ratings Seal for Sound applies to inlet sone ratings only.

FLA - based on tables 150 or 148 of National Electric Code 2002. Actual motor FLA may vary, for sizing thermal overload, consult factory.

GEN

Diesel Product Line

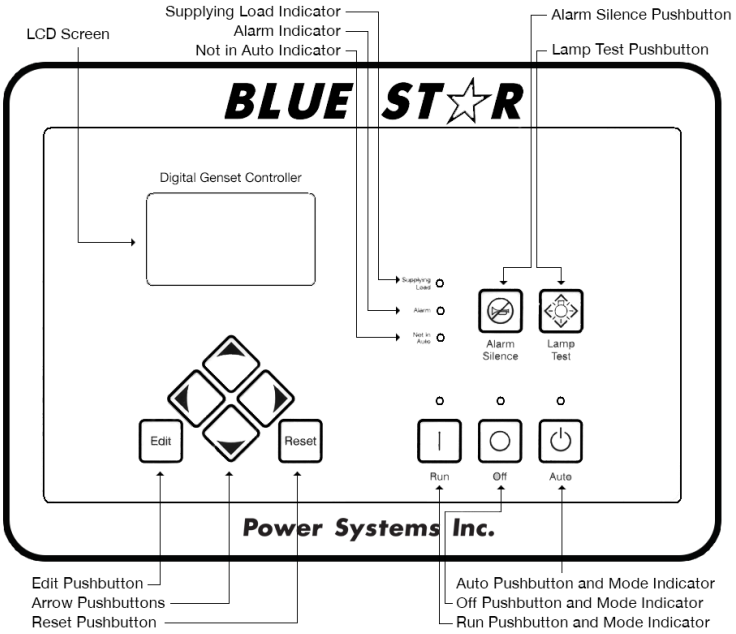
125 kWe

BLUE STAR Power Systems Inc.

DGC-2020 Control Panel

Standard Features

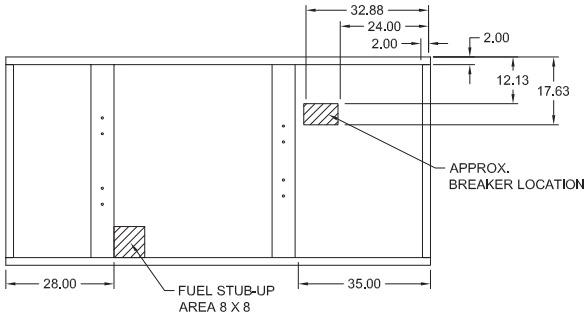
- Digital Metering
- Engine Parameters
- Generator Protection Functions
- Engine Protection
- CAN Bus ECU Communications
- Windows-Based Software
- Multilingual Capability
- Remote Communications to RDP-110 Remote Annunciator
- 16 Programmable Contact Inputs
- Up to 15 Contact Outputs (7 standard)
- UL Recognized, CSA Certified, CE Approved
- Event Recording
- IP 54 Front Panel Rating with Integrated Gasket
- NFPA 110 Level 1 Compatible

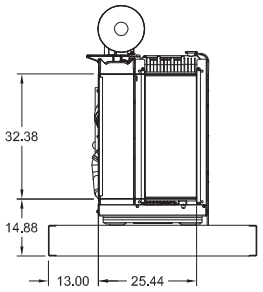


Weights / Dimensions / Sound Data

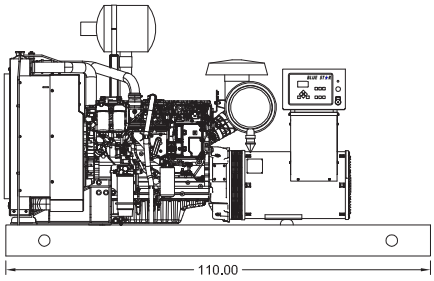
	L x W x H	Weight lbs
OPU	110 x 54 x 65 in	3,400
Level 1	130 x 54 x 82 in	4,300
Level 2	130 x 54 x 82 in	4,350
Level 3	164 x 54 x 74 in	4,575

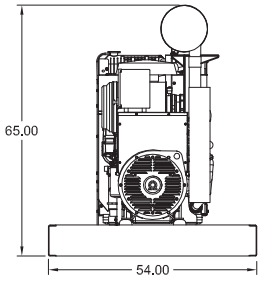
Please allow 6-12 inches for height of exhaust stack.





	No Load	Full Load
OPU	82 dBA	85 dBA
Level 1	80 dBA	82 dBA
Level 2	75 dBA	78 dBA
Level 3	71 dBA	73 dBA





Drawings based on standard open power 480 volt standby generator. Lengths may vary with other voltages. Subject to change without notice.
Sound data as measured at 23 feet (7 meters) in accordance with ISO 8528-10 at standby rating.